Welding Design & Fabrication

ESTABLISHED IN 1930 AS INDUSTRY & WELDING

JUNE 1961

STEVENS RICE
UNIVERSITY MICROFILMS
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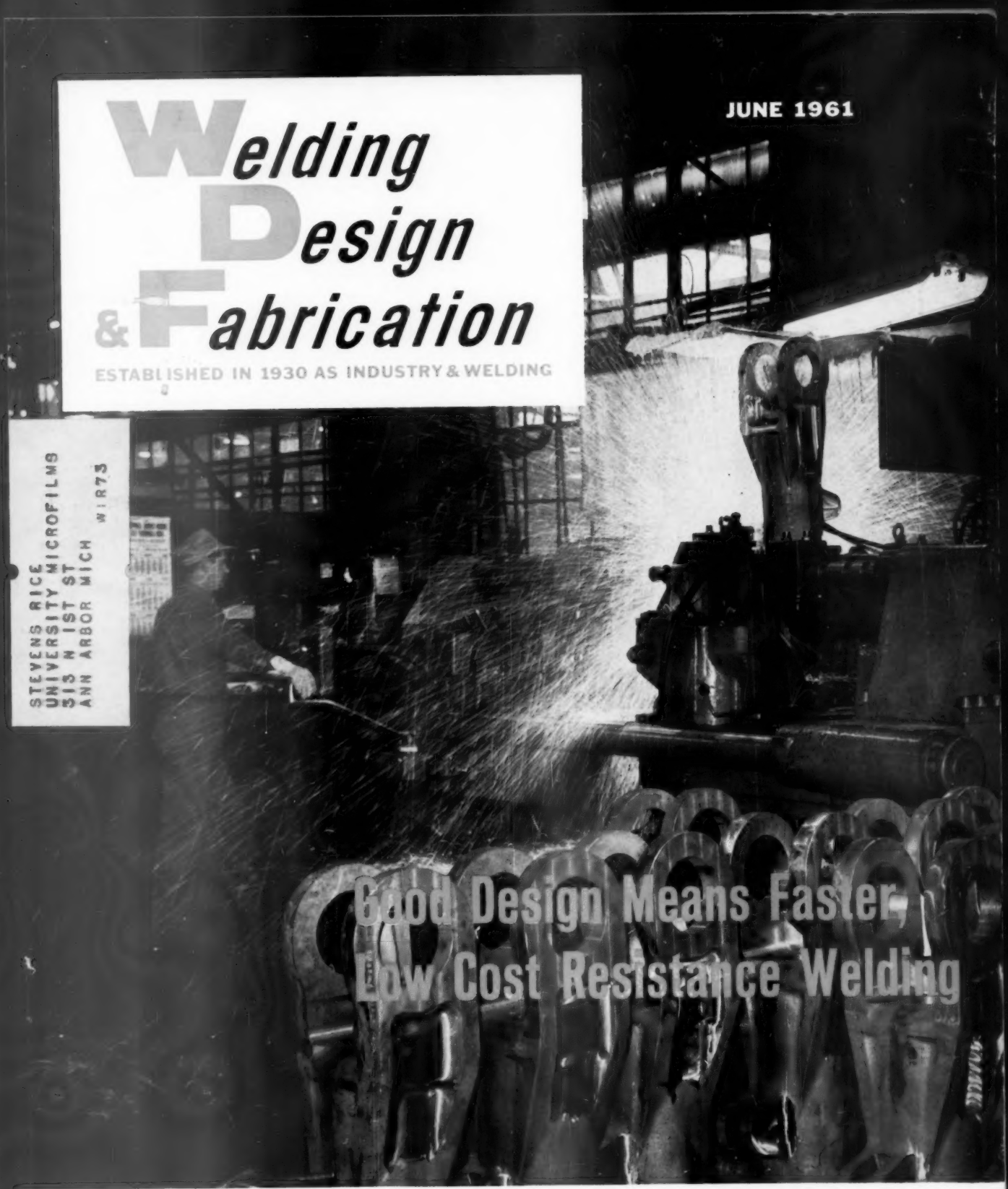

Good Design Means Faster, Low Cost Resistance Welding

AN INDUSTRIAL PUBLISHING CORPORATION MAGAZINE

ALSO IN THIS ISSUE

100 FIXTURES SPEED WELDING OF ALUMINUM TRAILERS

WHAT DO YOU KNOW ABOUT QUALIFYING WELDING OPERATORS?

IS THERE A FUTURE FOR FRICTION WELDING?

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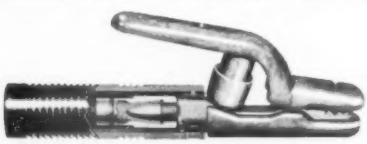
for trouble-free connections

These copper alloy quality Jackson electrode holders have a permanent-type cable connection device good for the life of the cable. It grips the cable jacket as well as the cable, sealing out moisture and dirt. The jacket can't slip back, the strands won't flex and break. The 'stinger end' of the holder can be replaced repeatedly without remaking the connection.

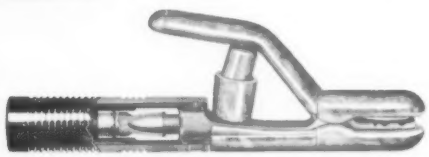
These ST holders are attached to the cable in a simple mechanical way, but the result is an almost fused connection having excellent conductivity.

Get the utmost in conductivity, ease of connection, and long life. Get lower holder costs when buying ST holder stinger end replacements. Get a Jackson Sealed Tight holder in your hands soon and you'll *see* why they're better.



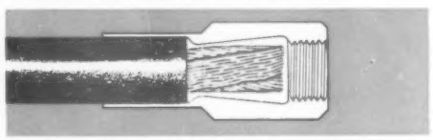
Model ST-3, copper alloy holder for electrodes through ¼" dia. Rated for 300 amps.

Model ST-5 copper alloy holder for electrodes through ⅜" dia. Rated for 500 amps.

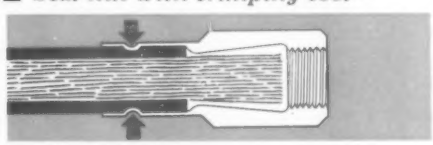


■ *Strip back the cable jacket—*

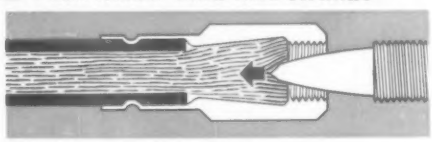
■ *Slide on the connection nut—*



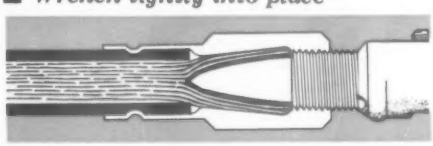
■ *Seal nut with crimping tool—*



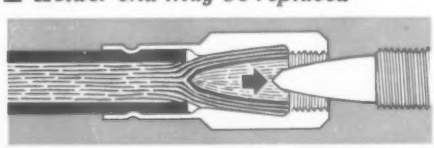
■ *Push holder stud into strands—*



■ *Wrench tightly into place—*



■ *Holder end may be replaced—*



■ *Connection assembly stays put!*

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For More Information Circle No. 38 on Reader Service Card.

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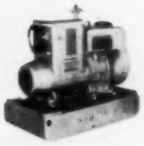

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reader's guide to

for June, 1961

COVER: An 800 KVA flash butt welder with 100-tons upsetting capacity is used by the Cleveland Pneumatic Tool Co., a Division of Cleveland Pneumatic Industries, Inc., to make landing gear axle beams from 4340 alloy steel forgings. See page 47 for a report on how good design can cut costs in flash welding operations like this one, as well as in spot, seam, and projection welding.

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Standards released by National Electrical Manufacturers Association give standard designations and definitions for a complete range of resistance welding controls.

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World's champion corn picker welded with M&T Murex electrodes

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BPA

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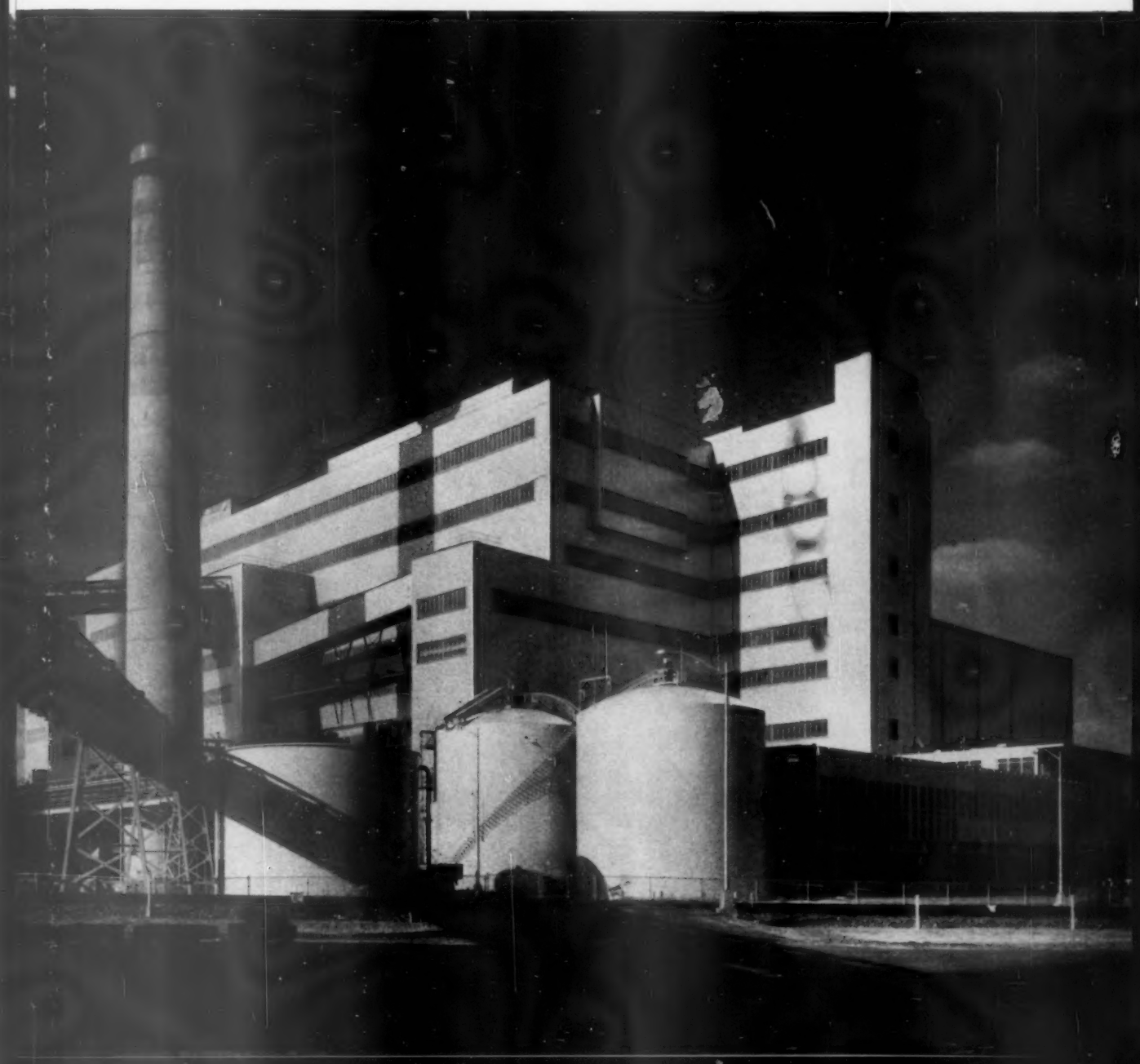
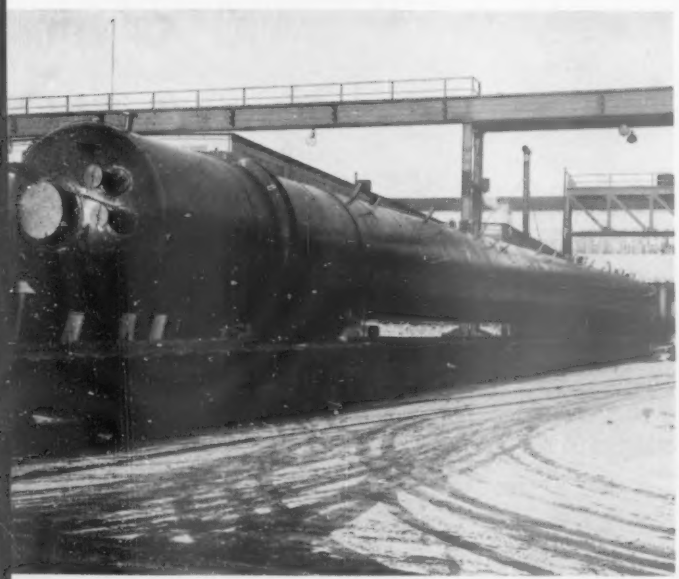
World's most efficient power plant depends on M&T Murex electrodes

To get more electricity than ever from a ton of fuel, Philadelphia Electric's 325,000-kilowatt Eddystone No. 1 generating station superheats steam to 1200°F, 5000 psi pressure. No other power plant equipment handles steam at such high steam conditions. In welding most of the pipe for Eddystone, The M. W. Kellogg Company used Murex electrodes — products of METAL & THERMIT CORPORATION, General Offices: Rahway, New Jersey.

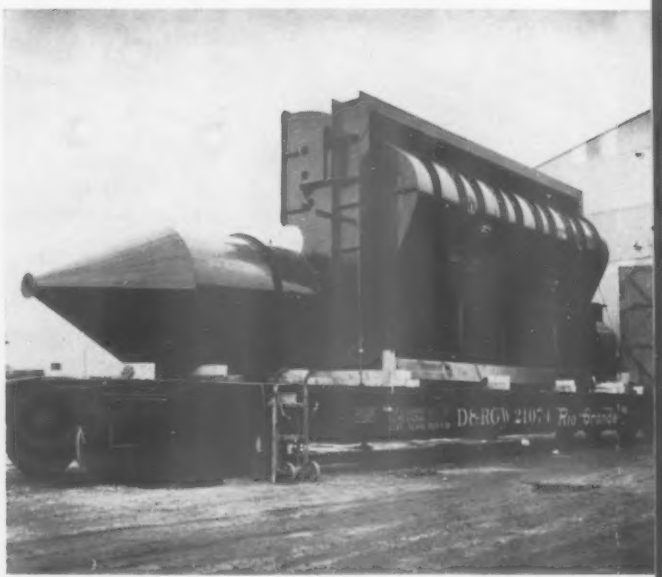
MUREX
PRODUCTS FOR BETTER WELDING



Size is no problem for fabricators



150-FOOT LONG steel petroleum processing tower will stand as high as a 15-story building when erected for Tennessee Oil Refining Company's refinery at Chalmette, Louisiana. The 8-foot diameter orthoxylene column is one of the longest ever shop-assembled in Chicago Bridge & Iron Company's Chicago fabricating plant. It was shipped on three flat cars.

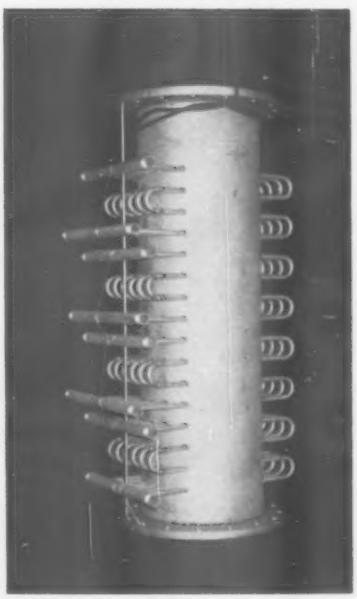


BIG AS A HOUSE, this 27-foot long coal filter with its 14 rotary disks will process up to 100 tons of coal refuse an hour. The filter is one of the biggest ever built for the coal industry. Graver Tank & Mfg. Company, a division of Union Tank Car Company, made it for Clinchfield Coal Company's Moss Mine No. 3 in Russell County, Virginia.

THIS COMPLEX chemical process reactor was produced for a large chemical manufacturer by the Stainless Processing Division of Wall Colmonoy Corp. in their Detroit plant. The main reaction chamber is fabricated of carbon steel; it is 18-inches in diameter and 6 feet long. Tubing is ¾-inch diameter carbon steel. A total of 192 tube-to-chamber joints was furnace brazed at one time.

Tube-to-head joints were welded prior to delivery to the Stainless Processing Division for brazing. Tubing elbows were also welded to straight sections before delivery.

The carbon steel tubes were brazed to the carbon steel reaction chamber using L. M. Nicrobraz brazing alloy. Brazing was done in a pure, dry hydrogen furnace under controlled conditions at 1950°F to 1980°F. Soundness of joints and leak-proof construction were proved by vacuum leak tests made after brazing.



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World's largest single-engine crawler welded with M&T Murex electrodes

The giant Caterpillar D9 tractor is a mountain of earth-moving muscle with a pull of 67,190 lbs. Using its seven-roller tracks, the Cat crawler can claw into the earth, push huge boulders, maul tons of dirt. The average tractor is dwarfed by the size of this monster: 23 feet long and weighing over 75,000 pounds, with equipment. In building its D9 line of crawlers, Caterpillar Tractor Co. used Murex electrodes – products of METAL & THERMIT CORPORATION, General Offices: Rahway, New Jersey.

M&T MUREX
PRODUCTS FOR BETTER WELDING

NEWS FROM AO

Leather patch on back adds protection against sparks, molten metal. Thumb and finger reinforced with leather patch, leather strap around thumb. Specially chrome-tanned split cowhide (SC3013).

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'Double thickness of leather on first finger and thumb. Gunn cut, wing thumb. Double-stitched flat seam at base of palm. Lined, one-piece back (SCTX100).

Specially chrome-tanned to resist abrasion. Gunn style, wing thumb, light weight. Lined, one-piece back. Flat, double-stitched seam at base of palm (SCTX200).

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LETTERS

to the editor

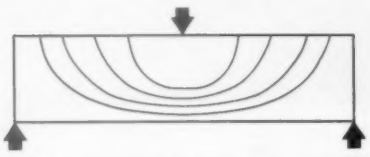
READERS RESPOND

Editor:

The article on how prestressed steel beams can replace concrete was very interesting. I think we should give credit to Bill Barnard for his creative pioneering.

From this report we learned that the welding distortion reduced the resisting capacity of the beam very much. The reason is the heat of welding melting the strain of steel beam which is the source of internal resisting energy. From photoelasticity, we can find another way (other than tack welding) to resolve this difficulty.

The photoelasticity tells us that in a beam under a given loading condition the trajectories of the stresses will be what is shown below.



That means the stress or strain in the central part of the beam is much greater than in the part at two ends. Therefore, if we change the welding procedure as follows, I believe the welding will cause less distortion.

1. Put the load on the beam.
2. Full weld the cover plate from the ends toward the center by the length just enough to transfer stress to plates.
3. Release the load.
4. Complete the welding of the beam.

The advantages of this is that we can use automatic welding instead of the expensive tack welding.

Hung-Chiao Cheng
Mississippi Valley Structural Steel Company
Melrose Park, Illinois

Editor:

We would like very much to digest and reprint the "Prestressed Steel Beams Replace Concrete" article which appeared in your April issue. This would be for our quarterly *Steel Construction Digest* which is distributed to approximately 24,000 people interested in steel construction.

William C. Brooks
Director of Publicity
American Institute of Steel Construction, Inc.
New York City

Editor:

Your April issue contains several articles of great interest. I would like to get four (4) copies each of the following:

1. "Prestressed Beams Replace Concrete"
2. "Stud Welded Shear Connectors: New Key to Construction Strength"

Ralph A. Bennitt, Jr.
chief engineer,
Augusta Iron & Steel Works
Augusta, Georgia

Editor:

Your article "Prestressed steel beams replace concrete" in your April issue was of particular interest to us.

We will appreciate your sending us about 12 tear sheets for distribution to State Highway Departments and architects.

R. B. Chesney
president
St. Joseph Structural Steel Co.
St. Joseph, Missouri

Editor:

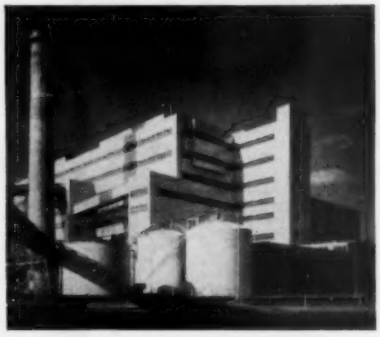
We understand you have run an article on prestressed steel bridges by Neil Welden, engineer with the Iowa State Highway Commission.

Would you please send us six copies of that particular issue.

C. S. Wendell
Information & Statistics
Iowa State Highway Commission
Ames, Iowa

• *These requests are typical of those which resulted from the special reports that we featured in our April AWS Welding Show Issue.*

Champion picker



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Iron Powder—for heavier and faster laydown of material than any other type of electrode.

Low Hydrogen—for a high quality weld on high tensile, chrome and carbon molybdenum steels.

Stainless Steel—for a weld to match the parent metal quality. Packed in new, safer resealable telescopic aluminum containers.

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M-T MUREX welding products

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- rigid construction
- complete - no extras
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- spindle and magnetic tracing

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SPECIFICATIONS

	Model SC-30	Model SC-42
Overall dimensions	36"x60"x58" high	36"x72"x59 high
Max. thickness of cut with std. blowpipe	8"	8"
Circle cutting range	0-30"	0-42"
Straight line cutting	65"	89"
Cutting speed inches per minute	3" - 30"	3" - 30"
Electrical requirements	115V - AC/DC	115V - AC/DC
Net weight of machine only	130#	160#
Net weight with semi-stationary base	438#	553#
Net weight with portable base	311#	371#
Shipping weight	add 40#	add50#

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for inspection of raw materials going into weldments, as well as of the finished weld itself, goes with you to the job wherever it may be . . . brings laboratory precision into the field and permits the most accurate evaluations of internal structure possible today. Simplified controls, easily mastered by non-technical personnel, are centralized on the front panel. Skilled service by factory-trained specialists is always available across the nation.

PORTABLE: Weighs only 37 pounds complete.

SENSITIVE: Detects all cracks; instrument response adjustable to suit exact quality requirements of any job.

PRECISE: Completely locates, and determines extent of, internal discontinuities.

ECONOMICAL: Costs $2750.

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All CESCO welding products, as illustrated in a new brochure available to the welding trade, are now offered for sale to welding equipment distributors at competitive prices.
CESCO invites all welding equipment distributors to send for a copy of the brochure and price lists. You will be interested in CESCO's New lightweight Plasti-Weld Plastic Filter Lenses which fall well within the transmission limits set by Federal Specifications for ultra-violet and infrared rays, as well as for transmission of visible light. New Nylonite Headgears, New wide-vision neoprene lens retainers and many other new product features give you the finest equipment available to offer your customers.
Address your inquiries to:
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CHICAGO EYE SHIELD COMPANY
2717 West Roscoe Street, Chicago 18, Illinois

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Your king-size weldment problems can be solved with Lewis king-size facilities and experience. We specialize in weldments from 1 to 35 tons and Lewis integrated facilities offer you complete design, welding and machining service for even the largest weldments.

DESIGN

Our engineering department includes weldment specialists experienced in machine design and cost-saving casting conversion. Lewis engineers will consult with your engineers from blueprint to fabrication of large custom weldments.

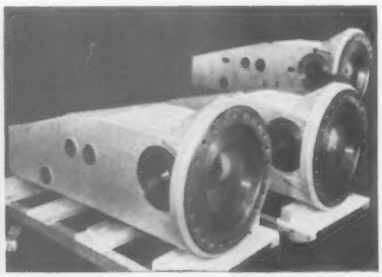
MATERIALS

Lewis is equipped to process both carbon and alloy steels and the usual commercially applicable non ferrous materials including monel, inconel and aluminum.

MACHINING

The wide variety of heavy duty machine tools of the Lewis Machine Division are available to you for the precise finishing of large welded structures and components.

Large flywheel fabrication



Precisely machined steel weldments

LEWIS

Please send me your booklet describing Lewis facilities. I am particularly interested in:
Design ☐ Weldments ☐ Fabrication ☐
Machining ☐ Special Machines ☐

10284-LW

THE LEWIS WELDING & ENGINEERING CO.
Interstate and Cross Road • Bedford, Ohio

Name_____
Title_____
Company_____
Address_____
City_____ Zone_____ State_____

For More Information Circle No. 43 on Reader Service Card.

MEN ON THE MOVE

in the welding industry

PROMOTIONS:

SKRALSKIS

DWYER

Omark Industries, Inc., Portland, Oregon, has named two vice presidents. **Edward P. Skralskis** is executive vice president in charge of all U. S. operations. **Howard Cutright** is vice president for marketing.

John R. Dwyer has been named assistant to **C. Burnell Abel,** vice president in charge of sales, Miller Manufacturing Co., Appleton, Wisconsin.

J. D. Webster has been named manager of industrial marketing at General Electric's X-Ray Department, Milwaukee. He is responsible for the sale and service of the Milwaukee plant's entire industrial X-ray and aerial reconnaisance camera output.

Frank C. Guise is industrial sales manager in the New York Metropolitan area for Picker X-Ray Corp., White Plains, N. Y.

Thor Power Tool Company, Aurora, Ill., has made three executive appointments. **John B. Dempsey** is manager of Silver Line electric and automotive tool sales. **Otto Schellenberger** is division manager of industrial sales. **A. V. Moroz** becomes Farm and Ranch Division sales manager.

T. H. Townsend, Jr. has been appointed regional manager for the Pure Carbonic Company's central region with headquarters in Cleveland.

continued on page 14

Why shout?

We don't make fancy claims, just good electrodes. We take great care in making them. We make all kinds, too.

All we ask is that you try a box. We think you'll be pleased with the way they weld. BUT: If they aren't — in your honest opinion — as good or better than any electrode you've used, bring back the box and we'll give you back your money.

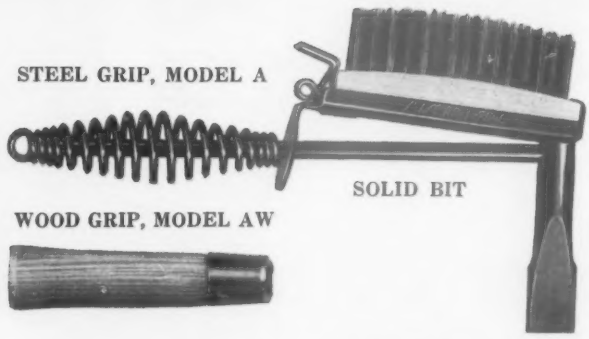
Square deal?

HARNISCHFEGER
Milwaukee 46, Wisconsin

P&H
WELDING PRODUCTS DIVISION

ATLAS | WIDE - BLADE TOMAHAWKS

WORLDS LEADING WELD CLEANING TOOLS



If Possible — They're Better than Ever!

Atlas "Dual Tools" are favorites with welders who like the idea of having the brush handy at all times. Now these tools are even more efficient than ever with our new wide blades—18% more chipping edge, more speed, fewer resharpenings, less worker fatigue. Choose your "Dual Tool" with the grip you prefer and the bit that best suits your likes. Ask your dealer for our FORM WCT-250 describing all our models.

Tough as they come!

33 MODELS

Each Atlas tool is made as well as we know how. Ask your welding supply dealer to show you the complete line.

ATLAS WELDING ACCESSORIES INCORPORATED
707 E. LEWISTON
FERNDALE 20, MICH.

For More Information Circle No. 15 on Reader Service Card.

MEN ON THE MOVE

continued from page 12

PROMOTIONS:

General Electric's X-Ray Division with headquarters in Milwaukee has realigned its industrial sales staff and has made these appointments: **Dr. W. F. Loranger** is chemical process sales manager. **D. F. Raymond** is manager of X-Ray products sales to the federal government. **H. W. Pickett** is in charge of instrument and sensor system sales. **S. T. Workman** is responsible for sales of radiation generators, image presentation systems, and x-ray supplies.

APPOINTMENTS:

CARL

CUNNINGHAM

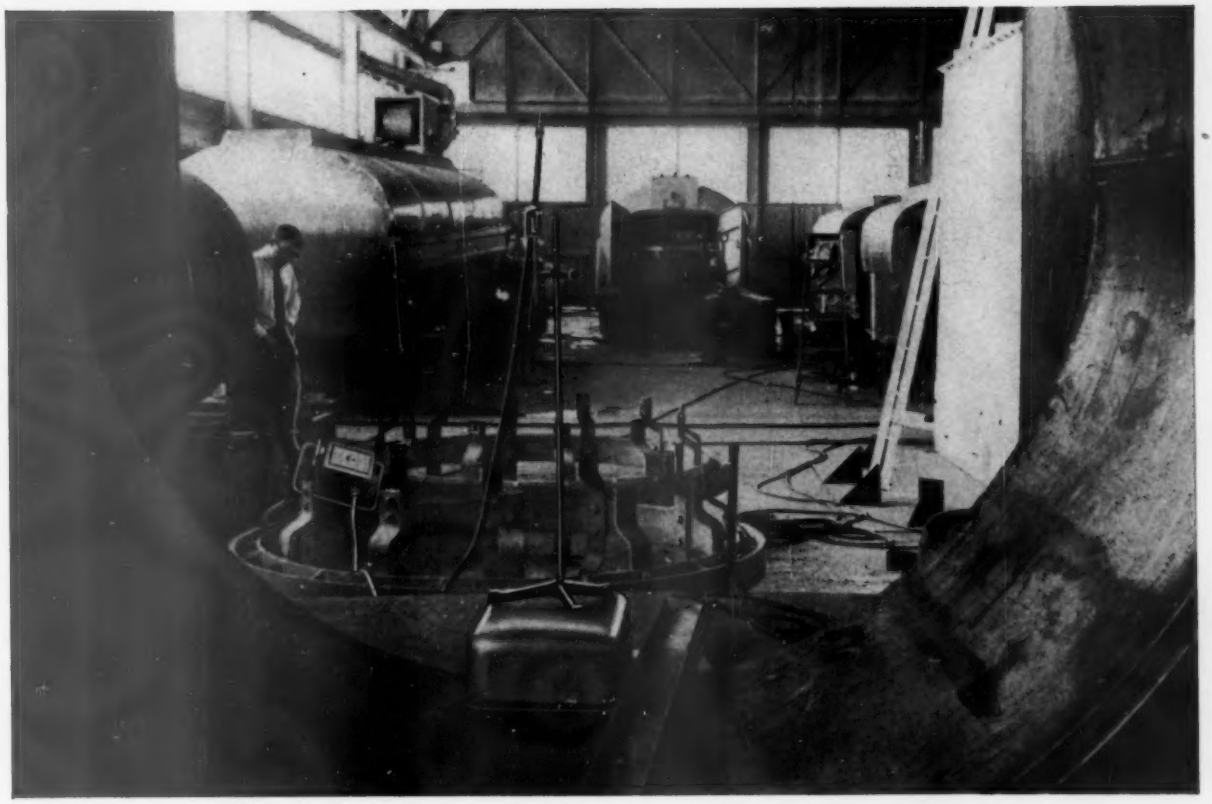
Norman Carl has been appointed vice president of Allan United Steel Corp., Cleveland steel warehouse firm. He was formerly a vice president of the Burdett Oxygen Co., Cleveland.

Lonnie C. Cunningham has been appointed vice president and general manager of Plant Service Construction Co. and Southeast Fabricators, divisions of Barnard and Burk Engineering, Inc., Baton Rouge.

Robert T. Everett has been appointed manager of selenium process for Vickers Inc., Electric Products Division, St. Louis.

ELECTIONS:

Robert C. Palmer has been elected president and a director of the R. C. Mahon Company, Detroit. Mr. Palmer succeeds **Walter F. Sheetz** who will continue as chairman of the board, treasurer, and chief executive officer.



"one-shot" radiography of this 24 foot steel girth weld

... or group inspection | of small parts

it's all in the day's work for a Tech/Ops unit

In the broad *Tech/Ops* line there's probably a gamma radiography unit that's precisely right for your inspection job. Iridium^{192} units (10 to 100 curies) for handling steel $\frac{3}{8}$″ thick and up, or light metals over 2″. Cobalt^{60} units (3 to 100 curies) for steel, brass, copper, superalloys up to 6″.

All of them are completely self-contained: everything needed for the job goes right along to it. Range in size and weight from a 58 lb. suitcase (*Little David*) to easy-rolling wagons (*Goliath*). They're simple to run, safe to use, rugged and dependable. The radiographs they turn out (with properly chosen techniques) are equal in every way to those made with x-rays — and so recognized by MIL codes.

Tech/Ops Radiography Units cost little to buy (or rent, if you like). Matter of fact, over 80% of today's isotope radiography is being done with units costing less than $3,000.

To find out where these versatile inspection workhorses may fit into your scheme of things, call any local Picker office (see 'phone book) or write Picker X-Ray Corporation, 25 So. Broadway, White Plains, New York.

Picker x-ray

For More Information Circle No. 62 on Reader Service Card.

WELDING MANAGEMENT

watches these developments

KITCHEN-CLEAN RAIL SHIPMENT of bulk materials is the prime objective for U. S. Steel Corporation's prototype Tenelon stainless steel covered-hopper car. All parts that come in contact with the lading are fabricated from USS Tenelon, a recently developed stainless steel which has almost twice the design strength of conventional austenitic stainless steels. USS Cor-Ten and Tri-Ten high-strength, low-alloy steels put additional structural strength into the car's underframe, center sill and other bracing and support members. Southern Pacific will soon test the car in actual service.

Discussing a model of the new car are U. S. Steel's R. W. Claypoole, manager-railroad products (left), and H. J. Mullin, vice president-sales.

THE LARGEST LIQUID HELIUM PLANT in the U.S. will be built by Linde Company, Division of Union Carbide Corporation at Amarillo, Texas. The plant will be able to produce 100 liters of liquid helium an hour from gaseous helium supplied by the government's nearby recovery plant at Soncy. Construction of the new plant is expected to be completed in January, 1962.

Linde will supply liquid helium to research organizations engaged in cryogenic work around the country. Uses for liquid helium (boiling point, —452°F.) include: low temperature research in electronics, solid state physics, and for rocket fuel systems.

A NEW PLAN, by which welding companies can sell their plant and equipment and immediately lease it back for 3 to 12 years, is offered to qualifying companies by Nationwide Leasing Company. Sale-Lease-back is designed for firms with big fixed asset investments which pinch them for working capital.

Feature of the plan: greater-than-book-value cash for fully- or partially-depreciated equipment. Custom-built equipment is also included. To qualify, companies must have at least $100,000 net worth, and show evidence of competent management and profitable operation.

For further information, write Nationwide at 11 South LaSalle St., Chicago 3.

A COMPLETE MERGER of Federal Machine and Welder Company with its parent company, The McKay Machine Co. has been given stockholder approval. Only State approval is needed for actual merger. Federal will be known as the Federal-Warco Division of McKay Machine Co. Present management, personnel and facilities will not change.

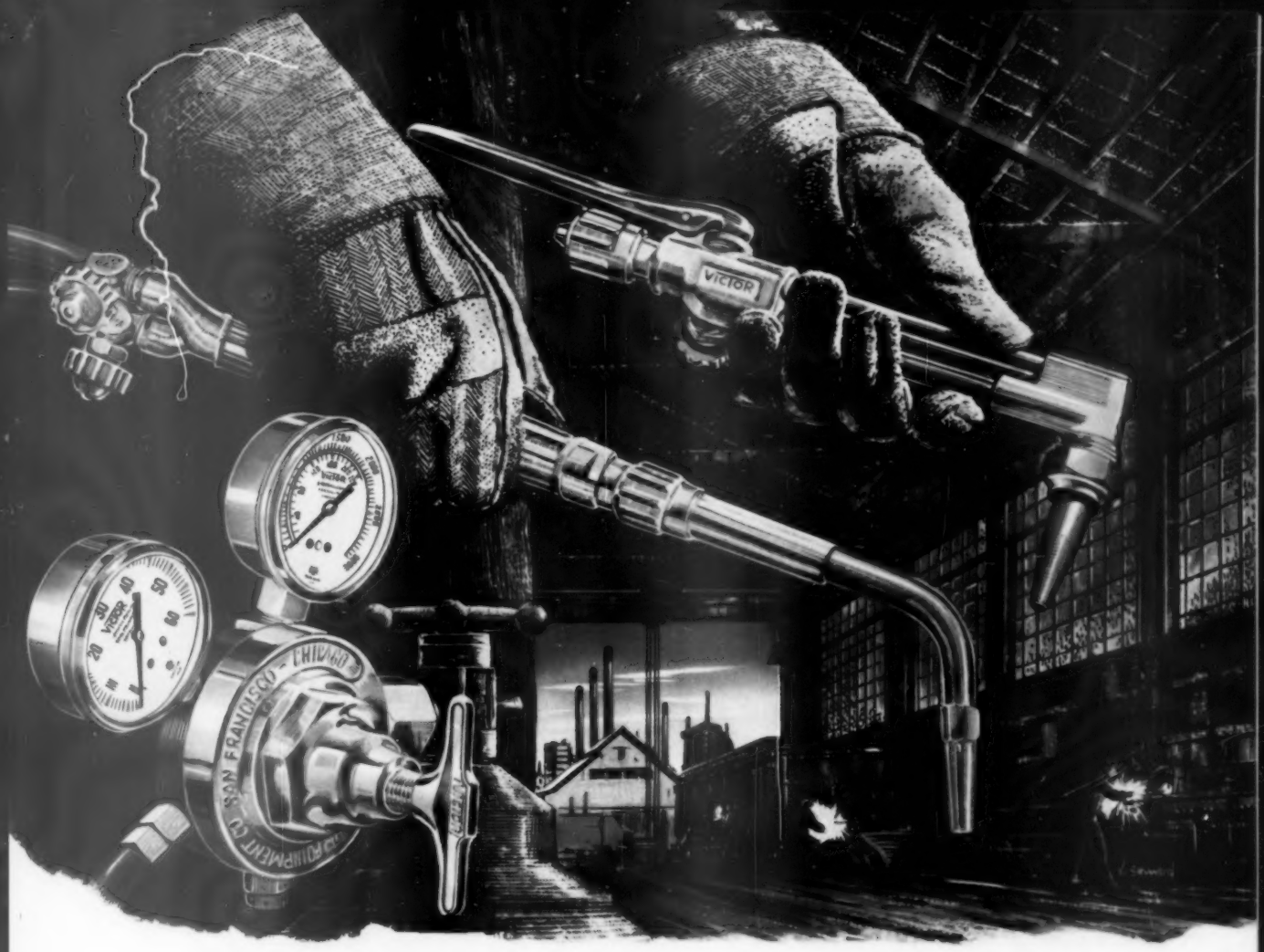
The merger culminates a series of moves during the past year whereby McKay expanded its product line into welding equipment and mechanical presses, and greatly increased its engineering and production capacity.

SPECIAL-BODY TRUCKS used in the welding industry can be leased for from four to eight years, according to Wheels, Inc., Chicago. Armund J. Schoen, president, said the long-term lease plan was an innovation for special-body, over-the-road equipment used by welding firms. This equipment can now be leased without full maintenance, repair, and garage service, he pointed out. Bodies and chassis are engineered to user specifications.

A RHENIUM DIVISION has been formed by Chase Brass & Copper Co. Rhenium is a precious metal with a very high melting point (5,756°F) and excellent electrical and mechanical properties, even at elevated temperatures. The first American commercial production of wrought rhenium was announced by Chase in January, 1959. Chase's rhenium sales have increased 400 percent since then.

TANTALUM PRODUCTION CAPACITY has been increased by 33 percent as the result of a 6-month expansion program just completed by the Metals Division of National Research Corp., Cambridge, Mass.

Circle No. 77 on Reader Service Card. ——→



For the man on the job...

THE VICTOR JOURNEYMAN UNIT

The most flexible, useful tools in the metalworking industry

For cutting, welding, melting, brazing, hardfacing, heating, heat treating, heat priming and descaling, The Journeyman Unit provides a complete outfit of VICTOR quality, standard industrial-type equipment, including:

Regulators... SR400 series single stage safety type
Welding Torch... Model 315 (9" long)
Cutting Attachment... Model CA2050
Welding Nozzles... Type 4, sizes 1, 3, 5*
Cutting Tip... Type 3-101, size 1* (cuts to 1")
Accessories... 25 ft. ¼" dual hose, goggles, spark lighter, wrench and instruction book (Form 1)

*Additional types and sizes can be added as needed to extend the work range of the unit.

The man on the job using the Journeyman unit will prove it costs less to own and operate VICTOR

Available at all VICTOR dealers in the U. S. A. for $175.95

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Great Dane Operator Terry Smith makes light work of blending a heavy weld bead on one of Great Dane's newest tank trailers. (Guard removed for photography.)

Bay State representative Hugh McKane shows the unique "Koolie Hat" shape to Great Dane Supervisor Malcolm Williams as Operator Terry Smith looks on.

"KOOLIE HAT WHEELS
SURE TAKE A LOAD OFF MY BACK"

That's just the main advantage of Bay State's "Koolie Hat" resinoid disc wheel, according to Operator Terry Smith. He's been using off-hand grinding equipment at Savannah's famous Great Dane Trailer Company for a good many years now, so he knows what he's talking about.

"Sure, there's a difference," says Smith, "and you can feel it in your arm and back muscles. With a regular weld-grinding wheel, you have to hunch over and fight it all the time so your muscles start aching in a few minutes. This "Koolie Hat" deal cuts smooth and easy without your putting a lot of pressure on it. And it doesn't skid around like the regular wheels either."

Well, that's one experienced operator's opinion. How about checking your own men? See if the new Bay State "Koolie Hat" doesn't cut your accident and fatigue-fumble rates . . . as well as other cost items.

For full engineering details and a no-obligation demonstration, contact your Bay State distributor or direct representative or write us. *Better grinding at lower cost . . . that is our business.*

NEW U-grade formulation complements original "Koolie Hat" R-grade wheel, ensures extra-long life. Designed specially for maximum effectiveness on high speed, air-driven or electric portable grinders that operate at 5200 r. p. m. or more.

BAY STATE ABRASIVES

Bay State Abrasive Products Co., Westboro, Massachusetts
In Canada: Bay State Abrasive Products Co., (Canada) Ltd., Brantford, Ontario.
Branch Offices: Chicago, Cleveland, Detroit, Los Angeles, Pittsburgh. *Distributors:* All principal cities.

BAY STATE WHEELS of PROGRESS

For More Information Circle No. 17 on Reader Service Card.

SIMPLIFY LOW-TEMPERATURE SILVER BRAZING WITH THESE SPECIALLY DEVELOPED FLUXES!

The correct selection of flux can offer unexpected help in speeding and simplifying production, minimizing rejects and lowering costs in low temperature silver brazing operations. The advantages to be gained by "selective fluxing" are *sufficiently important to warrant careful, thorough study!*

Silvaloy offers the most advanced flux developments in this specialized field. Here, is *a complete line of fluxes* . . . each providing outstanding performance, enabling you to select the correct flux for every possible low temperature brazing operation. The extra efficiency of Silvaloy "Selective Fluxing" is being proved daily on the brazing production lines of the country's leading manufacturers.

Call the Silvaloy distributor in your area for consultation and detailed information or, send for our booklet "A Complete Guide to Selective Fluxing for Low Temperature Silver Brazing."

Silvaloy fluxes are packaged in 65-lb. and 30-lb. drums, 5-lb. wide mouth jars (5 to a carton), 1-lb. and ½-lb. jars. The wide opening of the 5-lb. package makes it a most practical, time saving dispenser that also enables the operator to make use of every bit of flux in jar.

SEND FOR THIS COMPLETE GUIDE TO FLUXING

ENGELHARD
INDUSTRIES, INC.
AMERICAN PLATINUM & SILVER DIVISION
231 NEW JERSEY RAILROAD AVE. • NEWARK 5, NEW JERSEY

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SILVALOY DISTRIBUTORS: A.B.C. METALS CORPORATION • DENVER • AUSTIN-HASTINGS COMPANY, INC. • CAMBRIDGE • WORCESTER • HARTFORD • BURDETT OXYGEN COMPANY CLEVELAND • CINCINNATI • COLUMBUS • AKRON • DAYTON • YOUNGSTOWN • MANSFIELD • FINDLAY • DELTA OXYGEN COMPANY, INC. MEMPHIS • EAGLE METALS COMPANY • SEATTLE • PORTLAND • SPOKANE • NOTTINGHAM STEEL & ALUMINUM DIV. A. M. CASTLE & COMPANY • CLEVELAND OLIVER H. VAN HORN CO., INC. • NEW ORLEANS • FORT WORTH • HOUSTON • PACIFIC METALS COMPANY LTD. • SAN FRANCISCO SALT LAKE CITY LOS ANGELES • SAN DIEGO • PHOENIX • STEEL SALES CORPORATION • CHICAGO • MINNEAPOLIS • INDIANAPOLIS • KANSAS CITY • GRAND RAPIDS DETROIT • ST. LOUIS • MILWAUKEE • LICENSED CANADIAN MANUFACTURER • ENGELHARD INDUSTRIES OF CANADA, LTD. • TORONTO • MONTREAL

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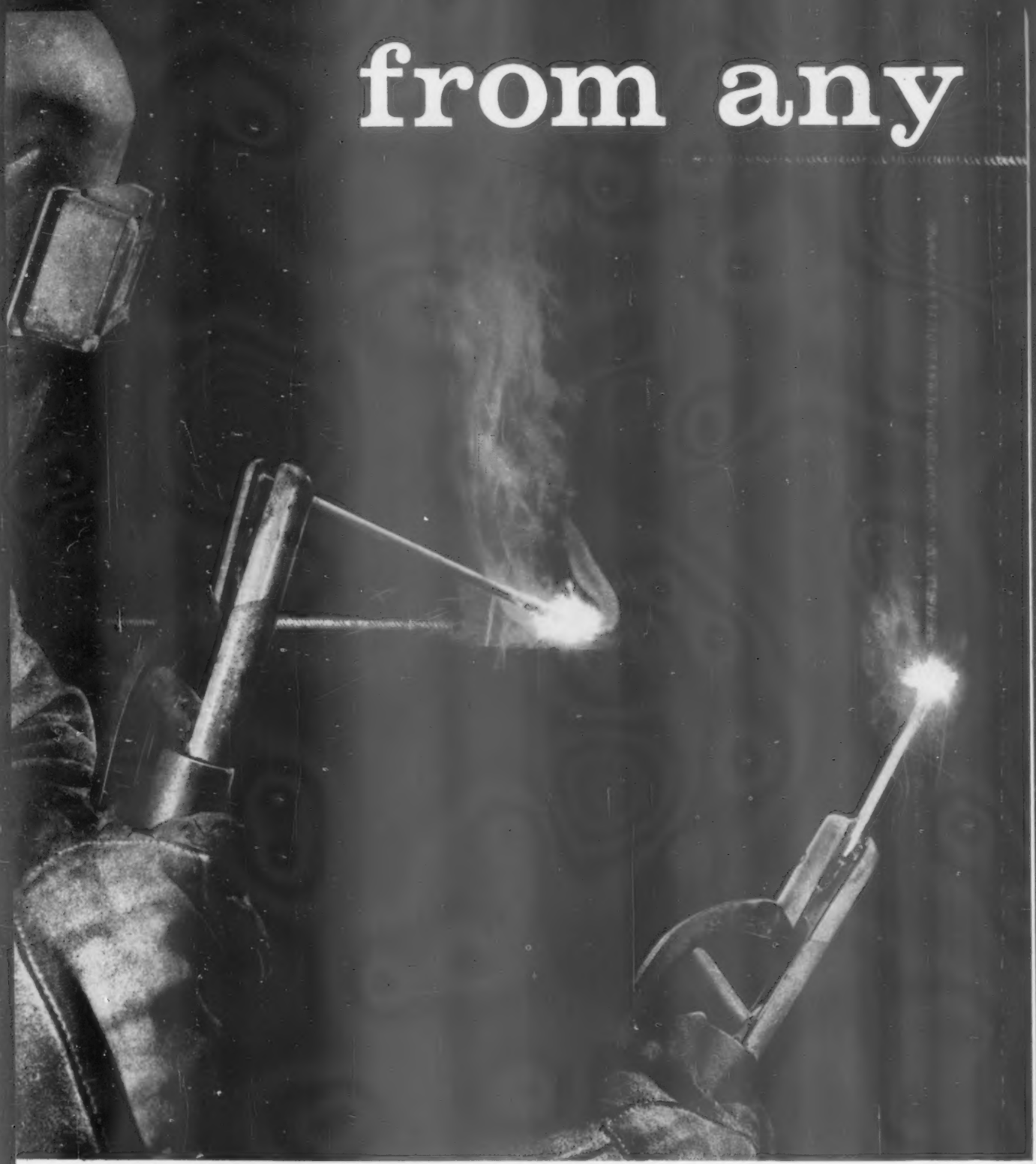
from any



HORIZONTAL — **Try the new SW610 on single and multipass fillets and you'll find it superior to any electrode in its class. A less convex bead, due to better wetting action with sufficient throat reinforcement to prevent cracking . . . a quieter, smoother arc, producing far less spatter . . . a stronger coating crater or flux crucible for better arc direction and deeper penetration. From the standpoint of value — greater operator appeal and higher deposition efficiencies, resulting in less cost per pound of deposited metal.**

VERTICAL DOWN — **Here's where the SW610 is really in a class by itself. It's the only E6010 electrode capable of depositing a vertical down stringer pass free of pits. And this really "shows up" where x-ray checking is required. This advantage, coupled with its strong coating crater and deep penetration, makes the SW610 a natural for pipe welding. From the standpoint of value — rejects and rework time are reduced to an absolute minimum, especially when radiographic requirements must be met.**

OVERHEAD — **Better arc direction is the secret of SW610's amazing out-of-position efficiency. No loss of arc direction due to electrode breakdown and weak crater. Instead, a strong coating crater produces better arc direction, enabling operator to put metal where he wants it . . . smoother metal transfer results in less spatter . . . fast-setting slag and good wetting action produce a desirable flat bead. From the standpoint of value — easy out-of-position welding with costly stub loss reduced to a minimum.**

you can put metal where you want it with the new A.O.SMITH SW610

The new A. O. Smith SW610 outperforms any electrode in the E6010 class. In fact, it's so good in all positions that you might say it's in a class by itself.

You get all this with the SW610: Strong coating crater for good arc direction . . . greatest resistance to breakdown . . . no pitting in the vertical down position . . . smoother metal transfer for maximum operator appeal . . . deep penetration for rough jobs . . . better wetting action, producing less undercut . . . less spatter, resulting in reduced cleaning time.

Welds too good to be true. All you have to do to test the SW610 is to send for free sample electrodes. Or get in touch with the A. O. Smith representative near you.

Through research . . . a better way

A.O.Smith
CORPORATION
WELDING PRODUCTS DIVISION
A. O. SMITH INTERNATIONAL S. A.
Milwaukee 1, Wisconsin, U.S.A.

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new

Cylinder Catalog

FREE TO YOU

The new Hackney cylinder catalog is now off the press. It's the most complete data file of its kind on modern cylinders for compressed gases, such as oxygen, nitrogen, argon, carbon dioxide, etc.

The catalog describes and illustrates the wide variety of Hackney quality cylinders. A detailed description of the well-known Hackney manufacturing process, plus special engineering data to help you select the right cylinders, makes this catalog your best ordering guide. Use the coupon below to order your free copy.

Pressed Steel Tank Company

Manufacturer of Hackney Products

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Hackney
DOMINION IRON WORKS

CONTAINERS AND PRESSURE VESSELS FOR GASES, LIQUIDS AND SOLIDS

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Gentlemen: Please send me a free copy of the NEW Hackney cylinder catalog.

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LIBRARY

of welding

Structural Design

"Design of Welded Structural Connections" by Omer W. Blodgett, design consultant, Cleveland, and Dr. John B. Scalzi, associate professor, Case Institute of Technology; 8½- by 11-inches, double wire bound, covered with simulated leather; 92 pages, illustrated with 124 drawings, photographs, tables, and examples; price $1:00 in USA, $1.50 elsewhere, postage paid; published by James F. Lincoln Arc Welding Foundation, Cleveland 17, Ohio.

This manual gives engineers, designers, architects, or fabricators a summary of the fundamentals and best current practices to help them design efficient welded connections for all types of structures once the forces and moments are known. The manual can also be used as a reference text on welded connections.

The reader is briefly acquainted with the arc welding process, the weldability of steel, distortion, erection, and inspection. He learns the design of connections using the elastic or plastic theories.

This coverage of connections includes classification of welds, strength and size of welds, and welding procedures. The manual covers design of connections for columns, bases, splices, beams, angles, seats, stiffeners, trusses, cover plates, and plate girders. For bridges it covers beams, girders, fatigue strength, and other design considerations. The plastic theory is presented, giving load factors for welds, rules for connections, corner connections, and beam-to-column connections.

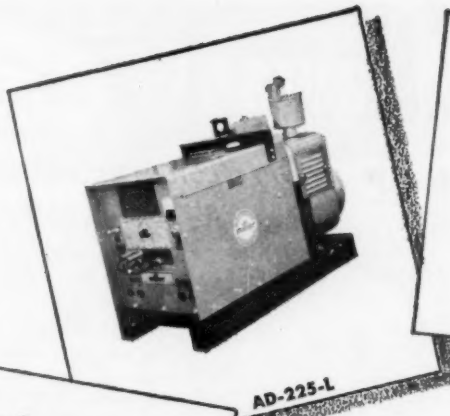
Resistance Welding

Third Edition of "Resistance Welding Manual—Volumes I and II" by Resistance Welder Manufacturers' Association, 1900 Arch Street, Philadelphia 3, Pa.; two volumes, 617 pages, $7.00.

Publication of Volume II completes the Third Edition of the Resistance Welding Manual. This companion to the previously published Volume I is fully illustrated with photographs, charts, and tables.

Volume I contains 355 pages and covers resistance welding processes and the materials they weld. Individual cost is $3.50.

Volume II contains 262 pages and covers resistance welding equipment. Individual cost $4.00.



AD-225-L

D-250-WE

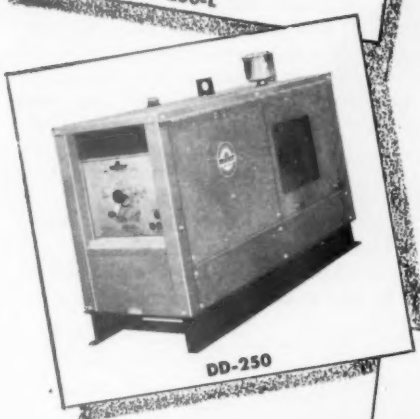
D-250-L

AEA-200-LE

FIRST and FINEST FAMILY of WELDER/POWER PLANTS

Miller was one of the first with a successful combination welder/power plant. This established a lead never lost notwithstanding the most widespread efforts at copying and duplication. Shown here are gas and diesel engine driven welders in d-c and a-c/d-c models.

In this group there is a welder/power plant size, type and price to meet every practical need—all available with field-tested accessories and trailers.



DD-250

DA-300-L

DAH-350-L

Complete specifications will be sent promptly upon request. Please indicate model or models.

miller ELECTRIC MANUFACTURING COMPANY, INC. • APPLETON, WISCONSIN

EXPORT OFFICE: 250 West 57th St., New York 19, N. Y. • Distributed in Canada by Canadian Liquid Air Co., Ltd., Montreal

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MISSILE AGE PAUL BUNYAN

LIFTS 80,000 POUNDS

WITH THE STRENGTH OF

ATOM·ARC 'T'

Hufford Corporation specified all-welded construction for maximum strength, minimum weight

Transporting 80,000 pound rocket engine units and erecting them on test stands requires equipment that is unusual both in design and strength properties. Hufford Division of the Siegler Corporation met this challenging project for Thiokol Chemical Corporation with this mobile handling unit called the Transrector.

The first requirement as a transporter necessitated the use of a minimum weight material for fabrication to reduce the overall hauling load. The use as an erector made strength a highly important factor. This high strength to low weight ratio was achieved through the exclusive use of T1 steel. To retain the inherent strength of T1, the design engineers specified all-welded construction.

Alloy Rods Company's ATOM·ARC "T" more than satisfied Hufford's needs. The only electrode designed specifically to weld T1 steel in all applications, ATOM·ARC "T" weld metal physical properties equal or exceed those of T1 steel in the "as welded" or "stress relieved" condition for 100% design joint efficiency. ATOM·ARC "T" electrodes are also excellent for many other applications where high strength welds are required.

Detailed application information about ATOM·ARC "T" in data sheet form is available by writing Alloy Rods Company, P. O. Box 1828, York 1, Pennsylvania.

ALLOY RODS COMPANY

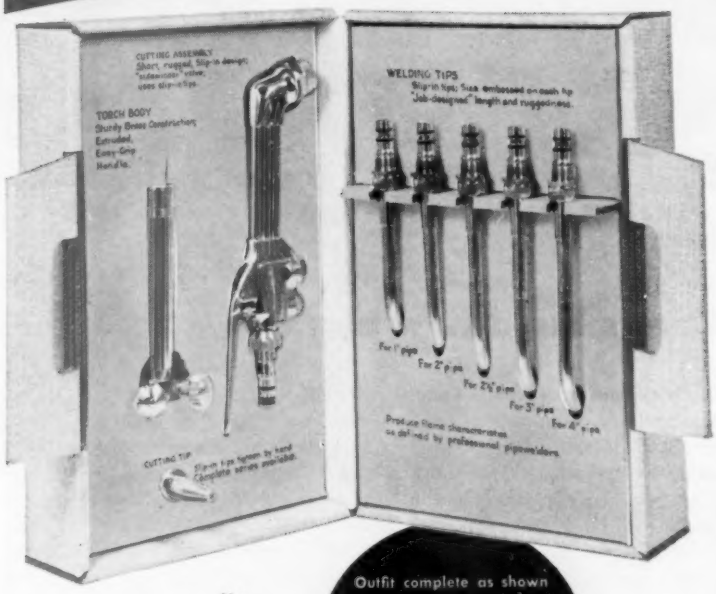
YORK, PENNSYLVANIA

SALES OFFICES & WAREHOUSES; BOSTON, NEWARK, PHILA., PITTSBURGH, BIRMINGHAM, CLEVELAND, CHICAGO, SAN FRANCISCO & EL SEGUNDO, CAL.—DISTRIBUTORS IN ALL OTHER PRINCIPAL CITIES

TWENTY YEARS OF LEADERSHIP IN THE DEVELOPMENT OF QUALITY ALLOY ARC WELDING ELECTRODES

For More Information Circle No. 6 on Reader Service Card.

SMITH'S PIPEWELDERS' *Special*



The Combination Outfit Designed by Pipewelders For Pipewelders!

Two years ago we retained a staff of professional pipewelders to tell us what features they needed in an outfit. One that would best perform the special jobs of the trade. We've been working closely with them since then . . .

Now here's the outfit . . . "job-designed" and field tested during a full year and a half of on-the-job performance. It's a precision tool, yet ruggedly durable. Great for new construction or maintenance:

"Special" Outfit	List Prices
PW1 Torch Body	21.00
PW306 Weld Tip	5.00
PW307 Weld Tip	5.00
PW308 Weld Tip	5.00
PW309 Weld Tip	5.00
PW310 Weld Tip	5.50
PC605 Cut. Assy.	36.50
SC1-6 Cut. Tip	4.25
Total	87.25

Outfit complete as shown

$74.50

- **WELDING TIPS**—tips slip-in and nut hand tightens, hex also provided on nut; tip rotates 360°. Short design with rugged copper section; precision flame stability. Recommended pipe size embossed on each of 5 tips.
- **TORCH BODY**—extruded "easy-grip" handle with brass forged butt; ball-type needle valves. Available in two lengths for operator preference.
- **CUTTING ASSEMBLY**—Slips into torch body, nut hand tightens; lever flips up for unrestricted access to nut; 75 or 90 degree head available.
- **CUTTING TIP**—Slips in, head nut hand-tightens. Complete series available.

New! 4-color wall charts showing flame traits of oxy-acetylene and oxy-LP gas in cutting, welding and brazing. Yours for the asking. See your Smith distributor or write Smith's.

Your Smith distributor has it in stock now . . . and if you like its looks and performance, you can buy it at a most attractive price.

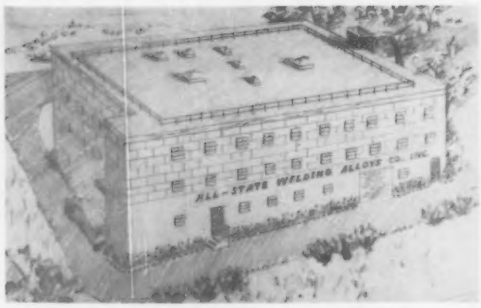
SMITH'S

SMITH WELDING EQUIPMENT CORPORATION

2633 FOURTH STREET S.E. • MINNEAPOLIS 14, MINNESOTA

For More Information Circle No. 68 on Reader Service Card.

NEW PLANT in Warren, Michigan, doubles floor space for Jackson Products.



NEW PLANT for All-State Welding Alloys will have shipping and receiving docks close to railroad.

GROUND IS BROKEN for Marquette's electrode plant.

Three welding manufacturers build new plants

NEW PLANTS are in the news as three manufacturers of welding equipment, electrodes, and accessories complete new plants, propose or start to build them:

WARREN, MICHIGAN

Jackson Products, Air Reduction Sales Co., has moved their entire manufacturing operation to a new plant at 5523 Nine Mile Road, Warren, Mich. Jackson gains a 100 percent increase in floor space in their new facility, a contemporary style building on 195,000 square feet one mile north of Detroit.

Need for greater research and design facilities and more warehouse space prompted this fourth move in the company's 27-year history. Jackson makes welding electrode holders and accessories and safety equipment for head and face.

WHITE PLAINS, NEW YORK

A new manufacturing building for All-State Welding Alloys Co. Inc., will be completed adjacent to the railroad siding opposite the company's main office and plant. The new plant will accommodate an advanced-design production method, originally developed to provide more rapid nondestructive testing of the company's Spoolarc aluminum alloys. This improved technique will also be used for All-State's new Spoolarc metals, including deoxidized copper, phosphor-bronze, silicon-bronze, aluminum-bronze, magnesium, and ferrous alloys. The new plant will also produce nuclear-grade aluminum electrodes.

Previous expansions at South Gate, Cal.; Glastonbury, Conn.; St. Louis, and Toronto, Ontario, decentralized the company's operations. The South Gate plant will be expanded in the future and will be a second supply source for the company's new line of spooled copper alloys.

MINNEAPOLIS

Marquette Corporation broke ground here recently for a new $450,000 electrode plant. The 21,000 square-foot plant will be ready for occupancy early this fall. It will double the firm's capacity for producing welding electrodes. It is the company's latest move in an expansion program. Just recently a second floor was added to the present electrode plant located across the street from the new building.

Marquette expects to save over $100,000 a year in production costs with new automatic wire-drawing equipment which will be installed in the plant. This equipment will draw hot rolled rods to wire sizes from 1/16- to ¼-inch diameter. Marquette previously purchased the finished wire stock.

more news on page 28

NEWS BRIEFS

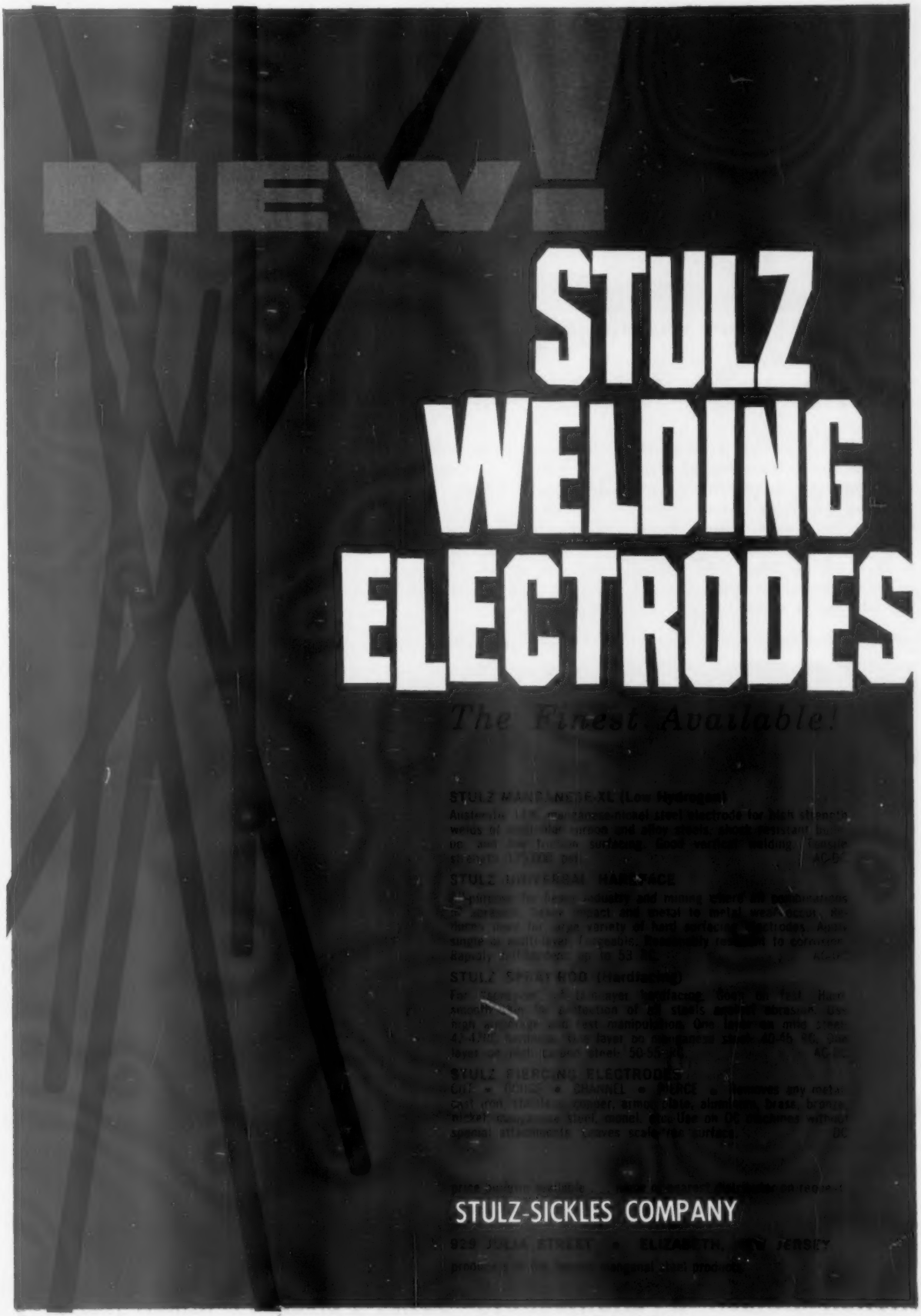
NCG CANADA LIMITED is the new name of the firm previously known as Alberta Oxygen & Acetylene Company, Ltd. It's in Edmonton. The company is a subsidiary of Chemetron Corporation.

THE GULF COAST is the location of two new air separation plants. Air Reduction Sales Company opened them at Tampa, Florida, and Baton Rouge, Louisiana. Both plants produce 30-tons of liquefied industrial gases (oxygen, nitrogen and argon) daily.

SOUTHERN OXYGEN COMPANY of Bladensburg, Md. (suburb of Washington D. C.) has been discussing merger operations with the Spencer Chemical Co. of Kansas City, Mo. Southern Oxygen produces and markets a full line of compressed gases and industrial and medical equipment and supplies. Spencer is a diversified chemical company with interests in plastics, fertilizers, industrial chemicals, coal and nuclear fuels.

A NEW ACETYLENE PLANT to supply Colorado Fuel & Iron Corp. is now under construction at Pueblo by Linde Company, Division of Union Carbide Corp. It will have a capacity of 1.5 million cubic feet per month and will also supply acetylene to other industries in the Rocky Mountain area.

A NEW SALES and distribution policy has been established exclusively for welding equipment distributors by Chicago Eye Shield Co., manufacturer of safety protective equipment. Prompted by the steady growth of its welding equipment line, the company says the policy assures new and existing welding equipment distributors that they can resell Cesco welding products at competitive prices.



For More Information Circle No. 72 on Reader Service Card.

MOBILE WELDING LAB and instructional trailer is used to demonstrate hard surfacing.

Alloy Rods puts hard surfacing classroom on wheels

YORK, PA: A mobile welding lab and classroom is being used by Alloy Rods Company to demonstrate hard surfacing techniques and to explain the selection of wear resistant alloys. The entire unit is housed permanently in a 35- by 8-foot custom-built trailer and includes a sealed-off welding lab and a classroom with 12 desks and chairs, built-in projectors for slides and films, screen, and blackboard for illustrating classroom discussions.

Introduced at the AWS Welding Show, the classroom on wheels will tour the country, visiting users of hard surfacing materials and Alloy Rods' distributors.

The trailer's walls feature illustrations of typical hard surfacing applications, plus a display of arc welding electrodes and wear resistant alloys.

The welding lab (in a sealed-off area at one end of the trailer) is fully equipped for demonstrating.

more news on page 30

Settling filter chamber fabricated of SA-302 manganese moly. steel to operate at 2400# pressure and at 1200°F.

50 YEARS EXPERIENCE IN DESIGN AND FABRICATION

Equipped with X-Ray apparatus and stress relieving furnaces

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- Hoppers, bins, stacks, ducts, tanks or any steel plate fabrication.
- Erection or installation at your site.
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H-43-4 MULTI FLAME HEATING TIP ASSEMBLY

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HEAVY-DUTY INDUSTRIAL WELDING AND CUTTING OUTFIT

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The heavy-duty industrial outfit designed for shop use or where easy portability is desired

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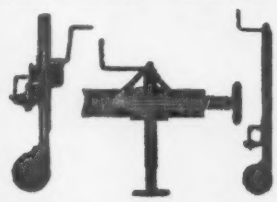
BULL DOG AXLE ASSEMBLIES

BULL DOG JACKS



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Complete Spindle End Assemblies for 2,500, 4,000 and 5,000 lb. capacities Per Pair. Available in complete assemblies or individual parts — Spindle Ends, Hubs, Wheels.

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Circle No. 33 on Reader Service Card.

FROM Great Britain (left) and from Switzerland, Belgium, The Netherlands, Germany and Denmark (right) . . .

International Industry Group Visits Eutectic Plant

FLUSHING, NEW YORK: Fifty industrialists and technical men from Europe, Australia, and Japan visited the world headquarters of Eutectic Welding Alloys Corp., here recently.

The guests included industrial leaders, physicists, metallurgists, university professors, and other representatives of welding societies and associations, and engineering institutes, who attended the 13th Assembly of the International Institute of Welding in New York City in April. Rene D. Wasserman, chairman of the board of Eutectic, has for several years been an AWS delegate to the IIW and a member of its Commission (committee) No. 1 on gas welding and allied processes, brazing, oxygen cutting, and metallizing by metal spraying.

Leonard C. Barr, Eutectic's president, was host for the tour which marked the first public inspection of Eutectic's new $250,000 office, laboratory and shipping building.

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THE chipping hammer WITH SWING BALANCE

This is the hammer with the balanced feel—swings easy, fits the hand properly, absorbs shock. *Less fatigue* and it's a pleasure to use!

CMD heads are made of ¾" square tool steel. They can be re-sharpened right down to the shaft!

Type A 20 oz., drift and right angle chisel.
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TYPE A TYPE C

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Another ⋈ Test System at work...

Magnatest eddy current unit, in which magnetic continuous weld pipe is tested for serious defects as it passes through sensing coils. Fully mechanized handling and automatic marking also provided by Magnaflux Corporation.

New Selective Eddy Current Test for Continuous Weld Pipe

This particular Magnatest SD-100 is one of a series of new Magnaflux-developed inspection systems for testing continuous butt-weld pipe and electric weld tubing. It precisely locates and marks the defects you want to find—at speeds to 600 feet per minute or more, on diameters up to 4".

The SD-100 is selective. It can be used to find varying degrees of gross defects. It will locate ring welds, caves, dents, scabs, saw cuts, slivers, burned welds, cold worked areas. Your needs are the determining factor . . . and with automatic marking and mechanized handling, available from Magnaflux, the per shift testing rates are determined mainly by your particular requirements.

Whether you test continuous butt-weld pipe or almost any other magnetic pipe, rod or wire, find out how one of the many ⋈ Test Systems can help you standardize quality and cut costs—per foot, per day or per 100 miles! Phone our local Magnaflux Field Engineer, or write Magnaflux Corporation, 7318 W. Lawrence Avenue, Chicago 31, Illinois.

MAGNAFLUX CORPORATION
A SUBSIDIARY OF GENERAL MILLS
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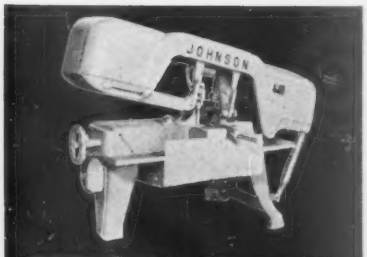
TEST SYSTEMS

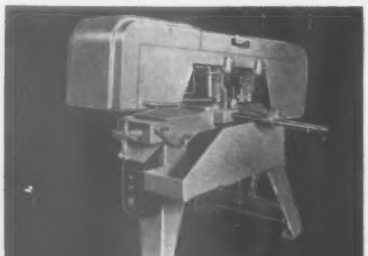
⋈ Test Systems include MAGNETIC PARTICLE, FLUORESCENT PENETRANT, THERMOGRAPHIC, EDDY CURRENT, ULTRASONIC, STRESS ANALYSIS, RADIOGRAPHIC TESTING, DYE PENETRANT & MAGNETIC FIELD

For More Information Circle No. 49 on Reader Service Card.

For More Information Circle No. 40 on Reader Service Card.



JOHNSON MODEL J . . . A big, rugged saw that cuts anything—anywhere! 10" rounds, 18" flats, heavy structurals and odd shapes. Available in wet or dry cutting models, variable speed drive and optional equipment.

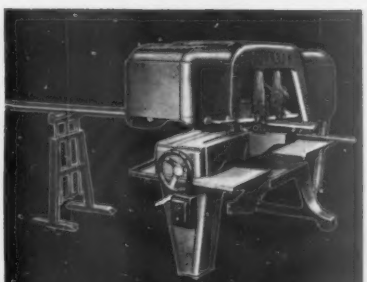


JOHNSON MODEL B . . . Also available in wet or dry, metal cutting models, variable-speed drive. Will easily handle 5" rounds, 10" flats, odd and irregular shapes.

Only Johnson offers *all* of the outstanding construction features and performance advantages—*at a lower initial price.*

Why pay more when you can have the best for less? Compare Johnson saws with others costing hundreds more, and you'll find that *only* Johnson delivers the life-long, maintenance-free efficiency you've always wanted.

Immediately available in five high capacity models to meet any metal cutting requirement—efficiently and economically.



JOHNSON ADJUSTABLE STOCK STAND . . . A necessity for operational safety and production efficiency. Solidly built, easily adjusted even under load. Practical and inexpensive.

JOHNSON "MOBILE" MODEL M . . . Same husky capacity as Model B, but wheel-mounted for fast, easy maneuverability indoors or out. Has self-contained handle, power line, tool box and accessories.

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CUT METAL *FAST,* WITHOUT DISTORTION USE MODERN NIBBLERS

They cut 10 gage stainless, 8 gage mild steel, 7 gage aluminum and brass without bending or curling the metal.

They cut 6" (and smaller) radius.

Models are available for cutting corrugated metal, fibre glass and plastic without cracking or chipping. Other models for cutting wire netting, irregular rods, gaskets, etc.

A MODEL FOR CUTTING ¼" COLD ROLLED STEEL AVAILABLE SOON!

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MERRILL
MATERIAL HANDLING DEVICES FOR THE MOST IN *Safety and Economy*

Imitated, but never duplicated, Merrill Lifting Clamps are Drop Forged to give you Safety in Handling and Economy in Operation.

6 SIZES

FEATURING THIS MONTH . . .

ADJUSTA CLAMP
One clamp take a wide range of grips. By simply pushing in or out on the adjustable jaw.

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Producers of Drop and Press Forgings
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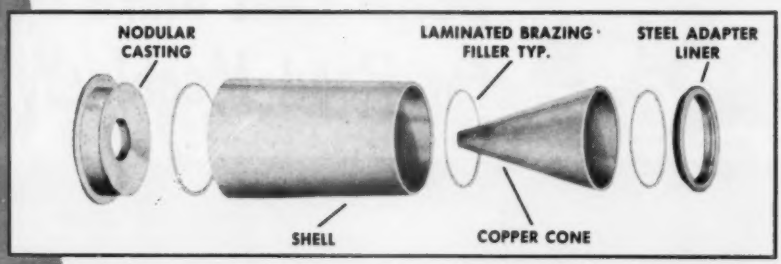

The four components of the nose assembly—nodular iron casting; low-carbon welded steel canister which measures 34" long, 15½" diameter at one end and 17¾" at the other; spun copper cone and low-carbon steel ring. The thinner rings are Easy-Flo 45 wire braided for precise alloy position and control.

Martin Develops New Induction Heating Methods to Braze Lacrosse Missile Assembly With EASY-FLO 45

One of the largest assemblies yet brazed by induction-heating techniques is a section of the Lacrosse missile being manufactured at The Martin Company's Baltimore Division. During development, one problem was posed by the variety of metals used. First it was necessary to braze a low-carbon welded steel canister and nodular iron casting. Then, to complete the assembly, a spun copper cone and low-carbon steel ring were joined to the canister. An induction coil was designed by Martin to accomplish this critical operation. Temperatures had to be restricted between 1300 and 1350°F to prevent a transformation change to the crystalline structure of the nodular iron. Martin's Materials Engineering Laboratory made careful examinations of this assembly and found that Handy & Harman Easy-Flo 45 Silver Brazing Alloy and B-1 Flux make possible the strong, uniform joints necessary to meet the stringent requirements the Company has set. Its low-working temperature, high strength, fast penetration and flow characteristics are only a few of the features which make this brazing alloy ideal.

More and more aircraft and missile components are being made with the aid of Handy & Harman silver brazing alloys and flux. The products described here are just two of the many available to help solve your problems...make your job easier and quicker. For a more complete picture of silver brazing and the advantages it offers you, write for your free copy of Bulletin 20.

Your No. 1 Source of Supply and Authority on Brazing Alloys

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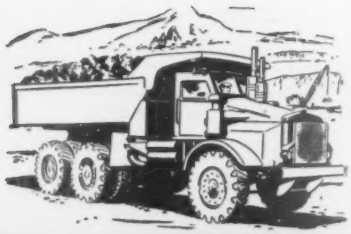


Better Cuts Make Better Fits for Road Machinery Builder

This rugged machine is in service two shifts — 16 hours a day — five days a week shearing parts of various thicknesses and shapes for heavy earth-moving equipment. It is rated for mild steel 12' x 1".

THE ease with which good, square, accurate cuts are obtained has made the Steelweld Shear of a road machinery manufacturer very popular with the operators and shop management.

Experienced with various type shears, they know the importance of easy knife clearance adjustment. They know that the best cuts are obtained when the correct clearance is provided for each thickness of plate being cut. As they point out, improper knife clearance on any shear often results in a heavy plate being cut at an angle with respect to the thickness, or light gauge metal burring.

Adjusting knife clearance on Steelweld Shears is such an easy, quickly-performed task that operators take care of it automatically. Turning a hand crank until a gauge pointer is on the proper metal-thickness figure is all that is necessary — a task done in a matter of seconds.

The big time saving made on knife changing as compared with most shears is another factor greatly appreciated. Easily done in two hours on a Steelweld, this job frequently requires all day on other machines.

Steelweld's unusual pivoted-blade operating principle makes possible outstanding cost-cutting advantages. For the complete story, send for the catalog below.

GET THIS BOOK!

CATALOG No. 2011 gives construction and engineering details. Profusely illustrated.

THE CLEVELAND CRANE & ENGINEERING CO.

9340 EAST 282 STREET, WICKLIFFE, OHIO

STEELWELD PIVOTED BLADE SHEARS

For More Information Circle No. 23 on Reader Service Card.

ALL THIS and NO EXTRA COST! Why settle for LESS?

Helmet QUALITY is FIBRE-METAL'S Trademark!

OVER 50 YEARS OF WELDING & SAFETY EXPERIENCE!

CHECK ALL THESE FEATURES FOR PROOF!

Check overall...and check detail after detail...and you'll see REAL SUPERIOR QUALITY by any comparison! These features give you *the best...the most for your money!* In value, in comfort, in convenience, in wide versatility of usefulness!

OVERHEAD ADJUSTMENT to raise or lower crown as needed...with 6-position positive lock. Easy to adjust.

NEW RATCHET ADJUSTMENT holds selected size. Designed for gloved hand. Based on Fibre-Metal design used dependably for many years. Widest headsize range!

PLASTIC MATERIAL: a) unaffected by moisture, hence no warping; b) conforms easily to all head shapes; c) easy to keep clean, to sterilize ...unaffected by detergents.

FREE-FLOATING ATTACHMENT permits headgear headband to fit all head shapes perfectly. No side helmet shell pressure on wide heads. No front-to-back pressure on narrow heads. There is no direct connection of headband to helmet shell!

ALL METAL PARTS ALUMINUM for light weight, durability, corrosion resistance (except necessary bronze and cadmium plated steel springs).

WIDE RANGE FRICTION JOINT. Long lasting, holds helmet up easily, needing only slight nod to return to operating position. Easy to adjust.

REPLACEABLE SWEATBANDS (snap buttoned!) of supremely comfortable Genuine Leather (also in simulated leather). Smooth overlap construction, no annoying wrinkles, padded.

4-POSITION HELMET STOP positions helmet for overhead and vertical welding. Easy, positive, no tools required. Allows normal raising of helmet on friction joints.

CHIN REST is adjustable to 3 positions...a real comfort feature, particularly for overhead welding. Also supports helmet shell for longer service life.

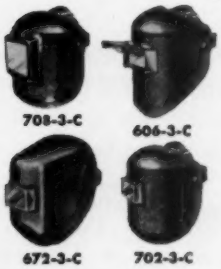
THE WELDING HELMET WITH THE WORLD'S MOST COMFORTABLE HEADGEAR!

More than 60 styles of helmets to meet all your needs

QUICK-LOK-equipped Helmet shells are available in all popular styles. Provides quick and easy shell attachment to Safety Caps or the new 3-Q Headgear!

MANY TYPES OF GLASS-HOLDERS, fixed or lift-front, of plastic, steel or Dowmetal. Rugged, light, durable...and insulated from outside to inside. Leakproof to light! All glassholder models replaceable for longer helmet life.

FIBERGLAS* Welding Helmets



708-3-C 606-3-C 672-3-C 702-3-C

FIBERGLAS shells are seamless, completely opaque†, compression molded of Fiberglas-reinforced thermo-setting polyester resin. With strengthening beaded edges, they are rugged, self-extinguishing, impervious to moisture, easily cleaned and sterilized, allow full ventilation.

VULCANIZED FIBRE Helmets

666-P9 270-3-C 460-3-C

Vulcanized Fibre Shells, seamless and fabricated, are LOWER PRICED, light in weight, "sealed" against light leakage, allow full ventilation. Other features as above!

*OWENS-CORNING TRADE MARK

†Even when non-reflective inside coating is scratched!

Bulletin No. 71 gives you complete helmet and accessory information.

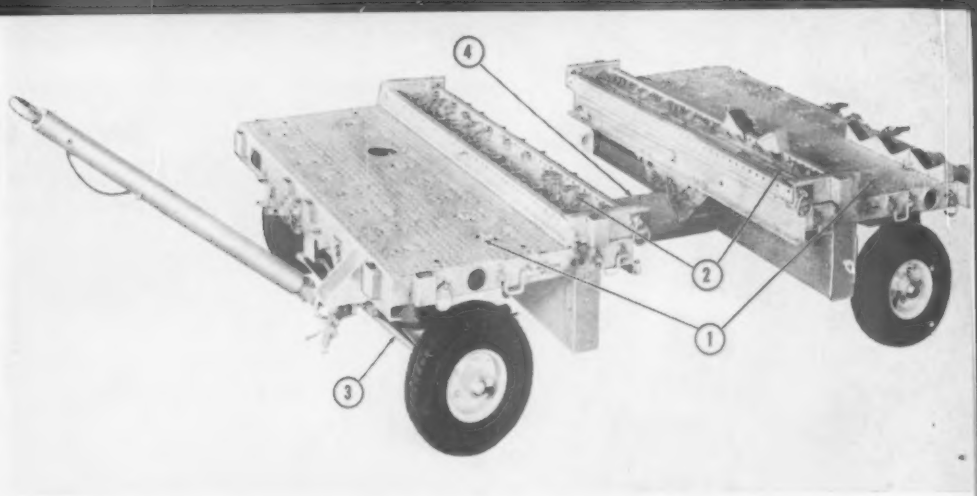
ASK YOUR WELDING & SAFETY DISTRIBUTOR!

The FIBRE-METAL Products Company | CHESTER PENNA.

In CANADA: Fibre-Metal (Canada) Limited, Toronto

For More Information Circle No. 29 on Reader Service Card.

here's how one company designed and fabricated aluminum trailers to rigid Air Force specs



1 Front and rear decks are welded in this fixture which is mounted on a positioner.

2 Deck door fixture has four clamps for welding doors.

100 welding fixtures speed

IN BRIEF: Careful design and precision welding built the Air Force a strong, lightweight, and versatile aluminum trailer for hauling bombs, missiles, and cargo.

CAREFUL DESIGN AND PRECISION WELDING.

They won United Manufacturing Company of Cleveland, Ohio, an Air Force contract for 166 multipurpose munitions handling trailers.

The Air Force wanted trailers light enough to move by air, strong enough to take the shock of taking-off, landing, or even crashing. They wanted versatile trailers that could haul cargo, not just bombs and missiles.

These are the Air Force specs for the MHU-12/M munitions handling trailer: 4,000-lb. capacity, 7-foot maximum width, 10-foot bed, and 1,575-lb. weight limit. The trailer and bomb load are ready stores. This means the completely loaded trailer parks on its automotically-retracting storage legs ready for towing to the flight line.

DESIGN SOLUTIONS

United Manufacturing's years of experience with lightweight aluminum running gear gave them a jump on their competitors. They instantly chose welded aluminum to suit the weight and strength specifications. To get versatility, they designed a trailer with folding deck doors. When open, these doors hold bombs or missiles, enabling lift trucks to take off or put on bombs or missiles. When closed, the doors convert the trailer into a flatbed for hauling cargo.

But, it wasn't that simple. United had first to get the contract. They took these steps.

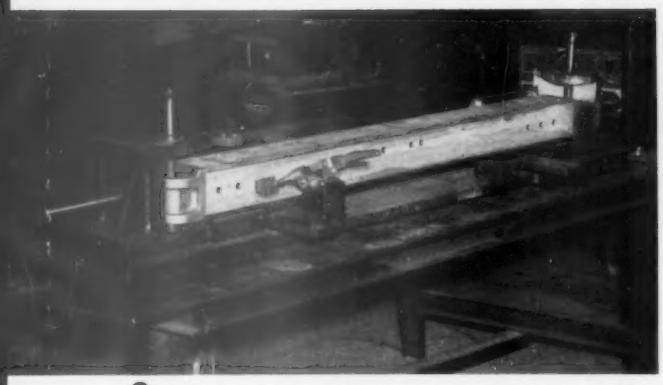
1. Submit a 2-stage proposal, explaining how to do the job and giving the costs for engineering and developing.
2. Receive an Air Force contract for research and development.
3. Make final drawings and bid on making 166 trailers.
4. Get the contract that gave them six months to tool up for the job and four more months to produce 166 trailers, these to be shipped at a steady pace of about 10 a week.

TOOLING UP FOR WELDING

In the six months they had for tooling, United qualified their welding procedures, certified their operators, and certified the chemistry of the five different aluminum alloys they would use.

JUNE, 1961
Welding Design & Fabrication

FINAL ASSEMBLY
fixture locates all parts for final assembly. It has four clamps and four locator pins.



3 Axle beam fixture contains two clamps and two pin locators.

4 Main beam fixture has 8 clamps and a trunnion swivel.

welding of aluminum trailer

They had to tool up for 340 different operations: Welding, forming, bending, shearing, and punching, as well as making 7,000 separate saw cuts.

The biggest job was developing 100 welding fixtures. These contain quick-acting toggle clamps, fixed and moveable locating stops. They hold dimensions to 1/16-inch tolerances, enable most welding to be done downhand.

Here are some of the typical fixtures:

Front and rear deck fixture: Four quick-acting toggle clamps hold eight 6061-T6 structural members (2 lengthwise and 6 crosswise) in the fixture. It has moveable locating stops inside and fixed stops outside. It is mounted on a balanced-type positioner.

Deck door fixture: Each trailer has a pair of doors. Four clamps are used in welding 6061-T6 deck plate sheets to 2- by 1½-inch 2024-T4 bars. Then they weld on two curved end pieces. These hinged doors are later bolted to the front and rear decks.

Axle beam fixture: Two clamps and two pin locators are used in welding 6061-T6 axle beams to 17M-T5 cast end blocks. These beams are bolted to the front and rear decks.

Main beam fixture: The welding fixture has eight clamps and a trunnion swivel. Four 6061-T6 gussets (⅜- by 6-inch channels) are welded to the 8-inch diameter 6061-T6 tube. The gussets are used to bolt the main beam to the front and rear deck assemblies.

Draw bar fixture: One clamp is used in this fixture that is spring-loaded and rotates. In it, 6061-T6 drawbar tubes are welded to cast 17M-T5 hinge ends.

Final assembly fixture: This fixture locates all parts for final assembly. It has 4 clamps and 4 locator pins.

WELDING DATA

United welds the five different aluminum alloys with 3/64-inch 4043 wire. They use two types of semiautomatic welding guns. One is water-cooled. The other is a smaller, more portable air-cooled gun for welding hard-to-get-at places. They weld at 42 ipm, using 145 amps.

United uses a 25/75 mixture of helium and argon to shield welds. When welding plate to castings, this heavier gas mixture gives better penetration with less porosity.

They only weld where the annealing does not weaken the assembly. Some assemblies are heat-treated after welding to regain full strength.

United inspects weldments for crack with dye penetrants. They also make spot X-ray checks. • •

this is Part III of a series of articles intended to show you how to use the economy and advantages of arc welded steel to reduce manufacturing costs.

Get economical welds by . . .

Job-matching standards and inspection

IN BRIEF: Perfect welds are fine, but expensive if they aren't necessary. There are savings waiting for those who will inspect a weldment in the light of the job it will do.

YOU ARE THE ONE who can answer—"Can my inspection costs be reduced?"

Before you answer, here are some things you should consider: Do you inspect welds for the job they must do, or do you inspect them to the highest standards, no matter what service requirements are? Obviously, unnecessarily high weld standards result in excessive costs.

Where do these unnecessarily tough standards come from? Maybe they're an overcautious reaction to a weld that failed because of improper, or poorly-timed inspection. Perhaps the standard used is a carryover from another joining process. Whatever the source, unsuited standards mean extra costs.

A midwestern structural steel fabricator had to make an unusual tapered beam. He butt welded the 2½-inch flange of the larger section to the 1½-inch flange of the smaller section with semi-automatic welding in a V-groove. Radiographs indicated a tiny imperfection in the middle of the weld, and standards demanded the removal and replacement of the weld. The fabricator did it, but in a way that allowed him to section and study the suspected area. Even after polishing and etching the weld throat, the imperfection was still invisible to the naked eye. Repairing the weld wasted time and money because the weld didn't carry enough stress to require perfection. The weld standards were too high for the job. Besides, the numerous starts and stops of repair welding could actually increase the stress in the part.

We don't say that radiography is a poor way to determine weld quality. It's an excellent way, but you must use judgement too. Even the ASME Boiler and Pressure Vessel Code permits some weld imperfections. Good standards, skillful interpretation, and a knowledge of how the part is to be stressed can save you money.

MANY STANDARDS

Inspection is necessary to manufacturing. But look at the weld standards that confront the manufacturer: Federal, State, and local government, trade association, engineering and technical societies, and individual company standards (see "What do you really know about welding specs and codes?" in our March, 1961 issue, page 36). These standards don't mesh; they differ, they confuse. And in the confusion, the job is often inspected to the most rigid rules, not for the load each part must carry. Welds with minor loads must be as good as heavily loaded ones. This is waste.

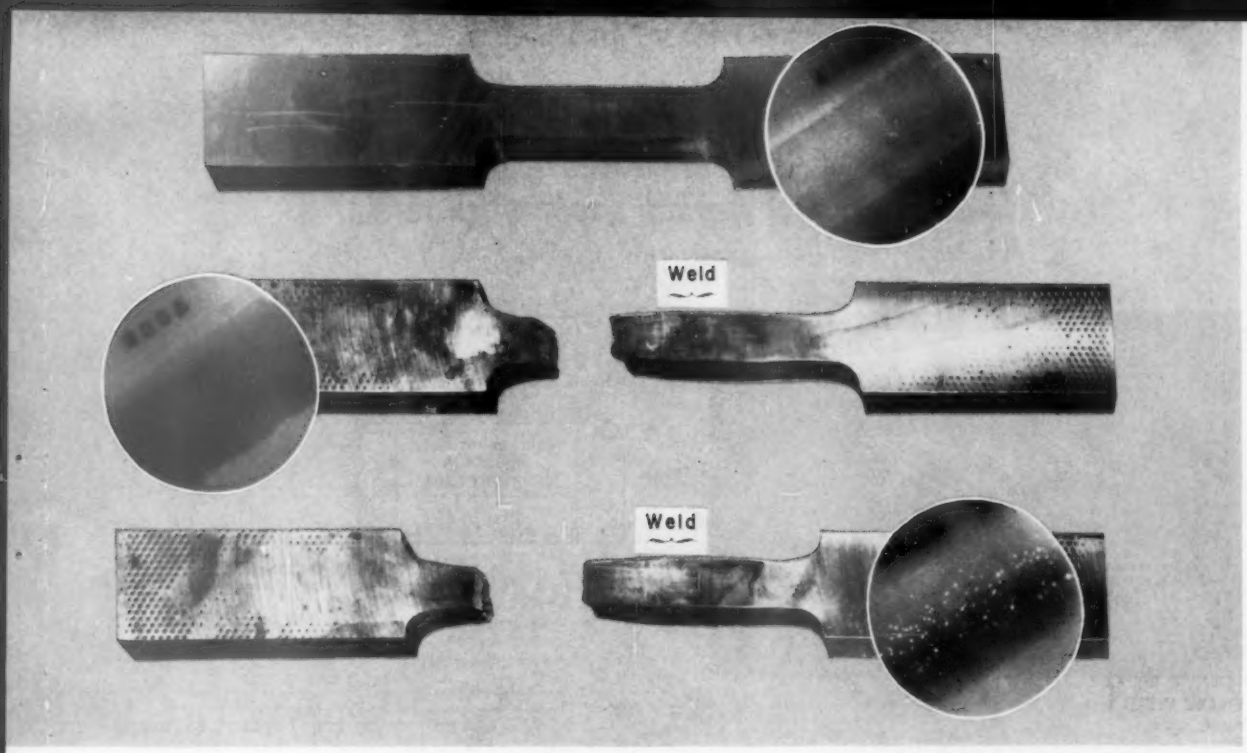
A machinery manufacturer, with a reputation for quality work, got a missile part contract. He met tough weld standards with close control of inspection and manufacturing. Evidently he did the job well for it led to another contract. This one was to build short-haul trailers for moving missiles from storage to aircraft loading. Company officials were stunned when they learned that the same strict weld standards applying to the precision parts *also* applied to the more ordinary trailer parts. The quality was not only uncessary on the heavy trailer weldments; it was practically unobtainable.

WELDS ARE STRONGER THAN YOU THINK

An ideal solution to the many, uncoordinated weld standards would be *one* set of reasonable standards that cover different classes of work; that make quality suit the job. Weld standards ought to recognize the capabilities of weld metal (see our January issue, page 34; and March, page 33). Don't believe old wives' tales about welds being weak. There are many examples of plates, not porous welds, failing. There are plenty of welds that have been purposely peppered with holes, then pulled in tension. The plate broke, not the weld.

This doesn't say: Make poor welds. It does say: Make them and inspect them to suit the job.

How many feet of fillets have been chipped out because of undercut on the vertical leg? Plenty. Overzealous inspectors love to see the chips flying. A little undercut is common. Actually, undercut is serious



POROSITY is not necessarily fatal to welds. These test bars broke in the plate in spite of the porosity shown in radiographs.

only if the joint is loaded in fatigue.

Tensile bars, mechanically undercut and statically loaded, prove that most undercut is harmless. The testers undercut one plate the upper edge of the weld 15 percent. The plate broke at 60,000 psi, well away from the weld.

Butt welds are usually stronger than the plate, even without complete penetration (see photo). This doesn't mean that you should shun standards that specify complete penetration for full joint efficiency. But you should know stresses before you condemn the weld.

BEGIN INSPECTION BEFORE WELDING

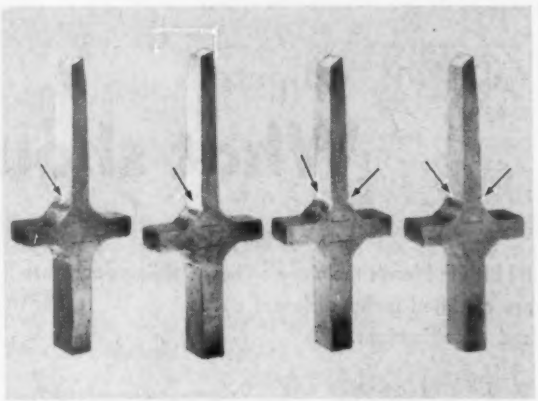
Good weld inspection begins before (not after) the arc is struck. The joint, the electrode, and the procedures affect the results. These things can't be changed once the weld is in, unless you do the job over.

Timed inspection saves money, especially in heavy plate fabrication. We know that welds usually crack—if they are going to—during the first few passes. This is the place to inspect them.

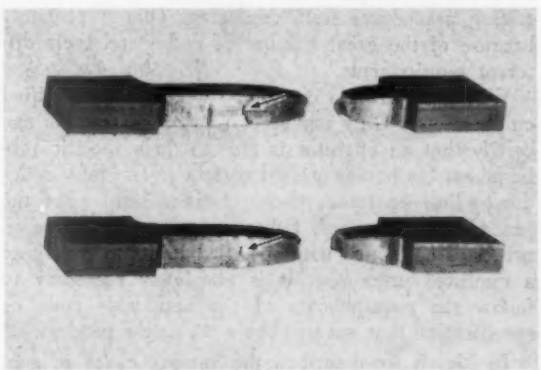
Here's good advice for welding inspection:

- Fillet welds aren't usually heavily stressed, and partial penetration makes radiograph interpretation difficult.
- Don't substitute tight specifications for loose manufacturing standards.
- Don't use exotic standards on ordinary work. • •

EDITOR'S NOTE: Part IV in this series dedicated to the reduction of manufacturing costs appears in August.

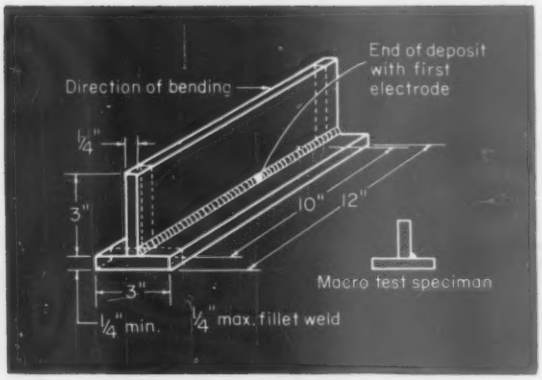


DELIBERATELY UNDERCUT mechanically at progressively greater depths (see arrows), these fillet-welded specimens broke in the plate on tension. Sample on the right was undercut 15 percent of the plate thickness.

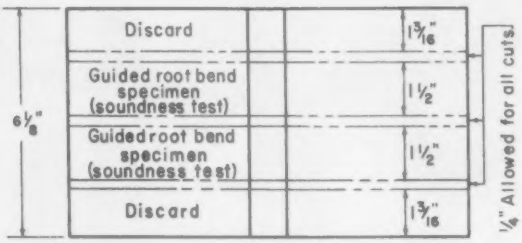


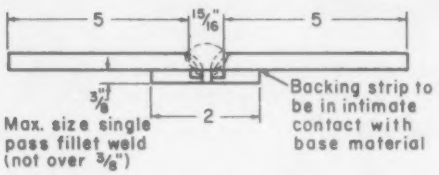
IS FULL PENETRATION NECESSARY? Not always. Neither of these tensile-tested butt welds has complete penetration, yet neither of them broke in the weld.

These are typical operator qualification tests...



FILLET WELD test like this one is the simplest and most commonly used.





DOUBLE FILLET WELD soundness test (right) has 15/16-inch root opening.

What should you know about

IN BRIEF: Here's the story on how welding operators are qualified under different codes and specifications.

WHAT IS A QUALIFIED welding operator? What is a certified welding operator?

Welding operators and the people who employ them ask these questions. To them, the qualification testing procedures seem confusing. This is probably because of the great number of codes and their different requirements.

Welding operators cannot be qualified or certified on their own. Only manufacturers or contractors can certify that an operator is able to do a specific job, based on his having passed certain tests. Many codes don't allow operators to be certified until after the procedure is certified. Other codes allow established processes combined with specified joints to constitute a qualified procedure. It is absolutely necessary to follow the requirements of the applicable code or specification that governs the work or the product.

In March we described the various codes in general terms. However, to qualify operators the specific code must be referred to. Employers have copies of the code for the work they are welding. An operator who qualified under a code for one employer is not qualified, even under the same code, with another manufacturer. These is one big exception to this rule. Operators qualified by the National Certified Pipe Welding Bureau may transfer from one member company to another without requalification.

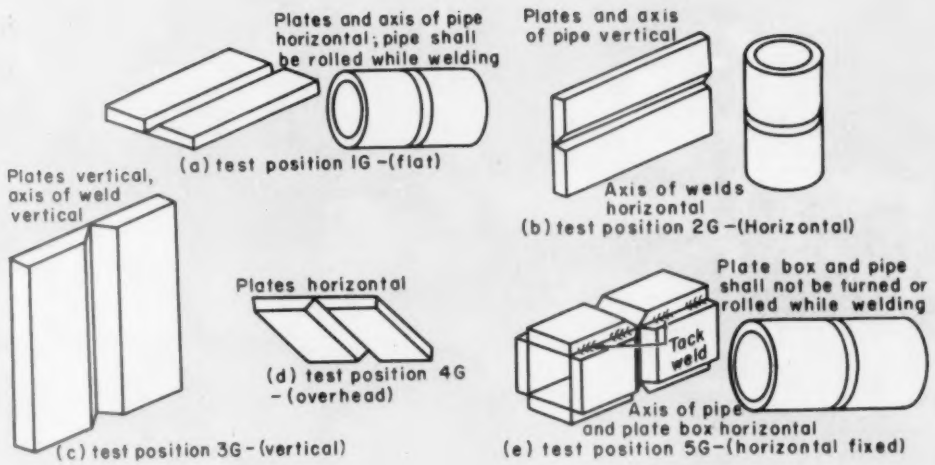
All codes require operators to qualify before they may weld on critical work covered by the codes.

WHAT ABOUT AUTOMATIC WELDING?

Automatic welding machine operators may have to qualify under some codes. Other codes require X-ray or sectioning tests to qualify. Here again, the code must be followed to the letter. Under many of the codes, the operator must requalify if he does no welding for a period of more than 90 days. If a man welds daily, requalifying is not required unless he does substandard work. Then, at the request of a welding inspector, the operator must take requalification tests. Certain other codes, particularly the aircraft code, demand requalification tests every six months.

QUALIFY FOR SPECIFIC WORK

Most welding codes establish tests that will qualify the operator to do specific work. This work may be limited by position, thickness, or base metal analysis.


Plates and axis of pipe horizontal; pipe shall be rolled while welding
(a) test position 1G - (flat)
Plates and axis of pipe vertical
Axis of welds horizontal
(b) test position 2G - (Horizontal)
Plates vertical, axis of weld vertical
(c) test position 3G - (vertical)
Plates horizontal
(d) test position 4G - (overhead)
Plate box and pipe shall not be turned or rolled while welding
Tack weld
Axis of pipe and plate box horizontal
(e) test position 5G - (horizontal fixed)

POSITIONS of test plates shown here are for groove welds.

qualifying operators?

asks **HOWARD B. CARY,** *director, Hobart Bros. Technical School, Troy, Ohio*

In some codes, changing the welding technique, use or absence of backing strips, and changing the welding process would require requalification. Changing the welding electrode type drastically demands requalification.

The American Welding Society standardized welding position terminology and welding joints type. They are uniformly accepted by all specifications. The joint design details and test specimen details have not been standardized so well. However, most specifications provide for test specimens that are generally similar.

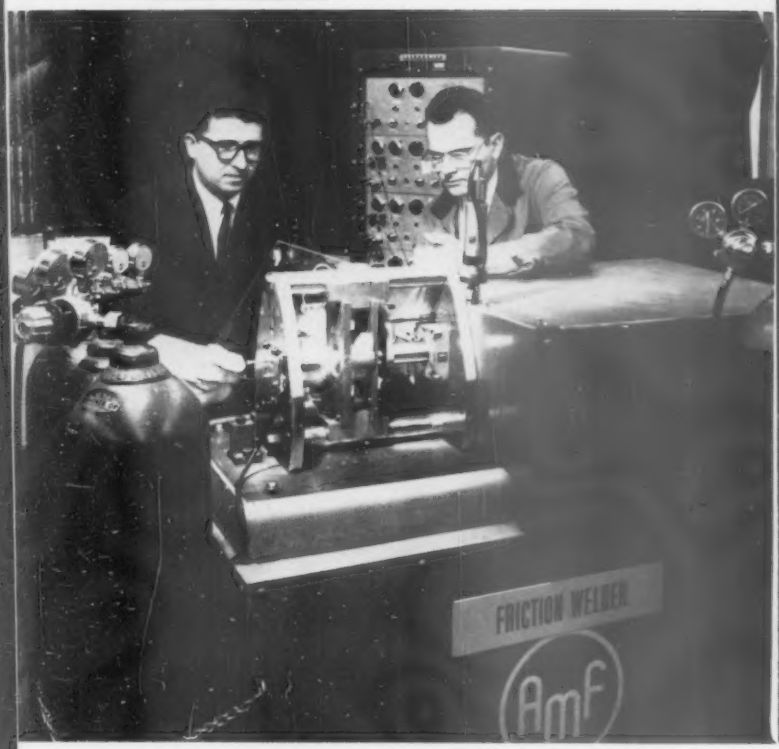
The simplest and commonest joint is the fillet weld. The AWS and ASME fillet weld specimens are similar. However, they are not tested in the same way.

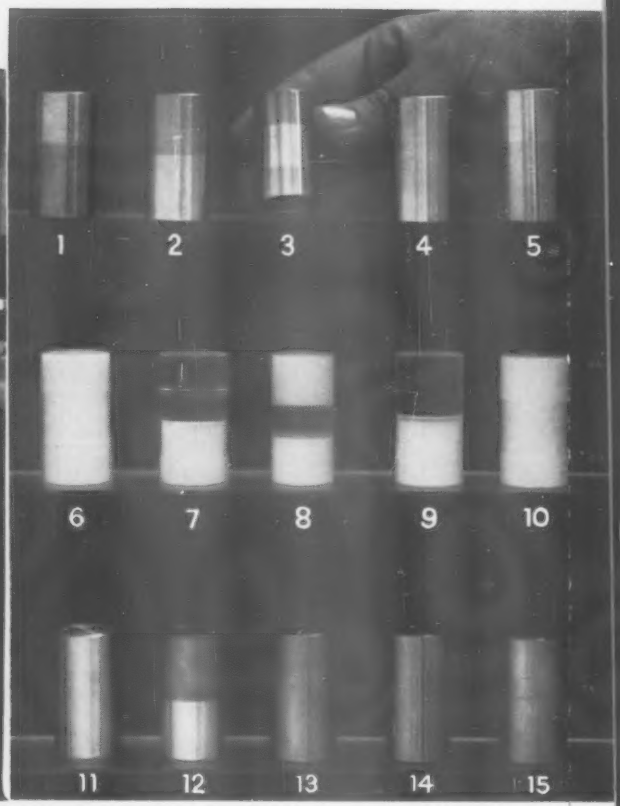
QUALIFYING FOR STRUCTURAL WELDING

Structural work sometimes uses the double fillet weld specimen with the 15/16-inch root opening between plates as another fillet weld soundness test. This weld specimen and most groove weld specimens are tested in the guided bend jig. This jig is standardized and is used for almost all guided bend testing. The 3/8-inch-thick specimen is usual, although specific tests call for other thicknesses. All of these welds can be made and are prescribed for the various welding positions. In general, these are horizontal, vertical, and overhead. These qualify the operator for all positions.

The other most widely used specimen is the groove weld in either plate or pipe. The test calls for welds made in all the welding positions if plate is used. Pipe can be welded instead of plate with the axis of the pipe vertical and with the axis of the pipe horizontal without revolving the pipe. Welding can be uphill or downhill, as the test requires. Passing these two test will qualify the operator the same as welding test plates in the flat, horizontal, vertical, and overhead positions. The thickness of the material becomes a factor in groove welds. Usually, specimens can be made in 3/8-inch material which will qualify the operator to weld on material up to 3/4 of an inch. Material over 3/8 of an inch, usually 3/4, must be used to qualify the operator for welding material of unlimited thickness. In the thicker specimens, the side bend test is used instead of the root or face-bend test. In these cases the specimen is cut and machined to a 3/8-inch thickness.

The aircraft welding specification has even different test specimens. They include simple butt welds in sheet and tubing, production welds, and the famous and complex cluster weld. Certification is based on classification, welding process, and the material being welded. The certificate of proficiency is good only at one plant. Reexamination is needed every six months. • •





FRICTION WELDING of high carbon steel is done in friction welding machine developed by Dr. Milton B. Hollander (left). Machine has made welds in these materials: (1) brass to copper; (2) brass to aluminum; (3) aluminum to brass to low carbon steel; (4) brass to brass; (5) brass to stainless; (6) delrin to delrin; (7) delrin to lucite; (8) delrin to lucite to nylon; (9) nylon to lucite; (10) nylon to nylon; (11) stainless to stainless; (12) stainless to steel to copper; (13) copper to aluminum; (14) copper to copper and (15) aluminum to aluminum. The weld line in similar materials is invisible even when magnified 500 times.

Is there a future for friction welding?

IN BRIEF: Constant study has helped American Machine & Foundry Company uncover valuable facts about friction welding. It is done on a laboratory's highly instrumented friction welding machine.

FRICTION IS USUALLY AVOIDED. It converts valuable mechanical energy to unwanted thermal energy. Researchers are trying to use this principle to friction weld.

You can friction weld by revolving or oscillating two metal, plastic, or ceramic objects against each other under pressure. In seconds, the rubbing surfaces become fluid, then the rubbing stops. Hold the objects rigidly together under pressure, they bond on cooling.

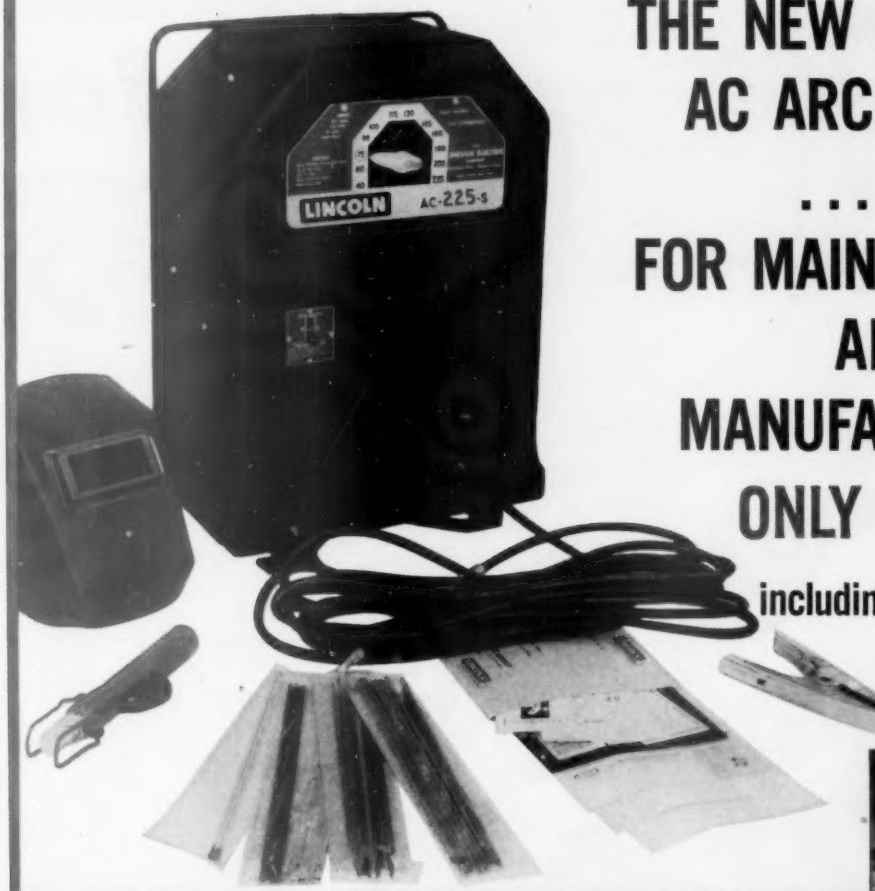
Friction welding is not new; some patents date back to the nineteenth century. Scientific study of the process has been limited until very recently. The study of friction welding has become intense abroad since the publication of a work by V. I. Vill in the U.S.S.R. in 1957. Since then many articles on the subject have been published in the Soviet Union.

The American Machine & Foundry Company developed and built a friction welding machine in its Central Research Laboratory. They experimented with friction welding and think their findings are more revealing than those published in the Soviet Union. One of AMF's most important discoveries is the fluid layer, not mentioned by the Russians.

The researchers feel they have uncovered vital information which should help lead to a practical use of the process. The AMF research laboratories are investigating the welding of a variety of materials including carbon, alloy and stainless steels, brass, aluminum, copper, and zirconium. They studied the affects of speed of rotation; machine rigidity; time and weldcycle sequence; torque; pressure; temperature; heat treatment, grain growth, metallurgy; and weld geometry. • •

LINCOLN ANNOUNCES

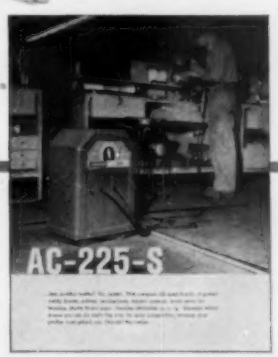
THE NEW 225-AMP AC ARC WELDER ... PERFECT FOR MAINTENANCE AND LIGHT MANUFACTURING



ONLY $158.00*

including accessories

*Price includes delivery; Colorado and West, $3.00 extra.



Ask for your copy of new AC-225-S bulletin which shows applications, lists specifications. Or write The Lincoln Electric Company, Dept. F-42, Cleveland 17, Ohio.

Just another welder? No, indeed. This hot new machine puts out a powerful 225 amps—lets you use up to 3/16" electrodes. You turn out big work—fast.

Welds all kinds of steel, too, because its excellent arc stability lets you use *all* AC electrodes. Weld mild and stainless steels, even crack-sensitive, high-carbon steels. Also, hardsurfaces, brazes, solders, thaws frozen pipes, heats parts for bending, straightening.

Only Lincoln offers this 225-amp machine. Comes complete with headshield, ground clamp, electrode holder, output cables, even sample electrodes—yet it sells for less than most smaller 180-amp machines. See your Lincoln dealer for a demonstration today. Prove to yourself how you can up your profits with this versatile, new machine.

LINCOLN WELDERS

THE WORLD'S LARGEST MANUFACTURER OF ARC WELDING EQUIPMENT AND ELECTRODES

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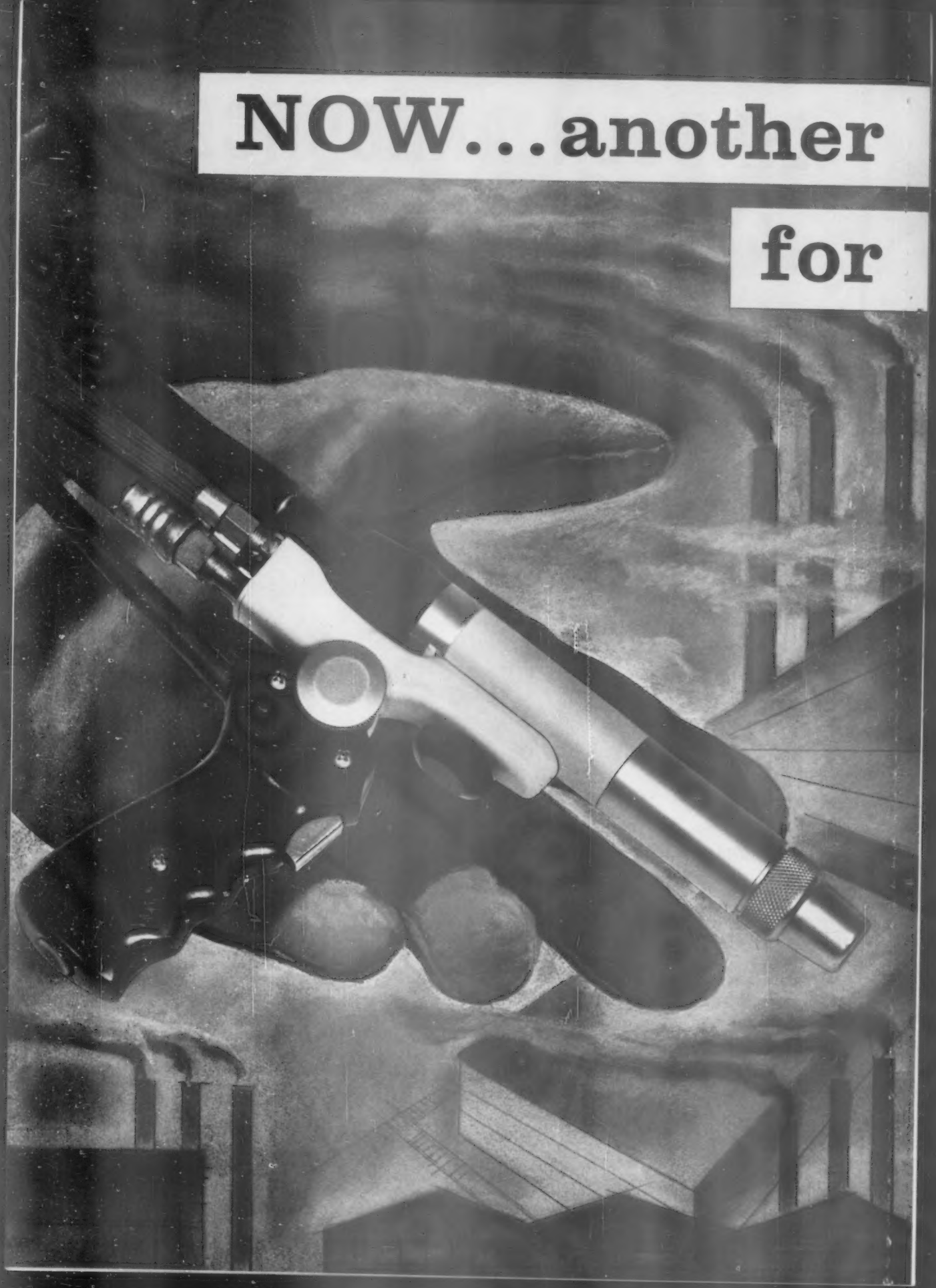


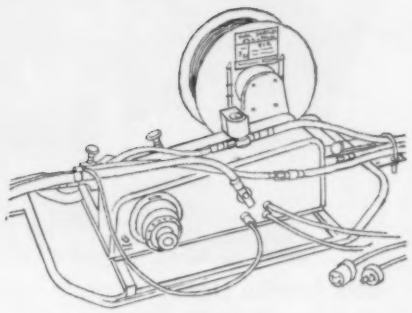
step forward

production welding

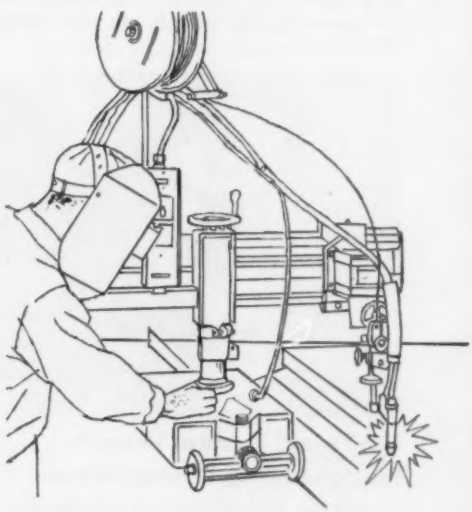
Progress means greater profits for you. The NCG AM-7 Gun for Automanual* welding is the newest, most improved consumable welding gun on the market. Its outstanding versatility, its low maintenance, its adjustable handle for welding ease and accessibility all mean increased production. And, it provides complete gas shielding using 25% less gas.

The multi-use barrel of the AM-7 Gun, designed for all MIG and carbon dioxide shielded welding processes, is interchangeable with the NCG A-10 Automatic Torch and may be used for all MIG, carbon dioxide shielded and TIG welding processes. And, for even greater versatility, a simple change of the guide tube accommodates ferrous or non-ferrous metals.

Send for complete information today. Ask for the new NCG Bulletin NH-142-E- 3F, NATIONAL CYLINDER GAS DIVISION OF CHEMETRON CORPORATION, 840 North Michigan Ave., Chicago 11, Illinois.
NCG sales offices, distributors and dealers in all principal cities.



The new WC series welding control units have features that were developed to meet field requirements. Designed for consumable electrode welding processes using argon, helium or carbon dioxide shielding gases, they provide maximum versatility and economy.



Multi-purpose barrel is interchangeable with the NCG A-10 Automatic Torch for MIG and TIG welding.

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*NCG trademark for semi-automatic welding process and equipment

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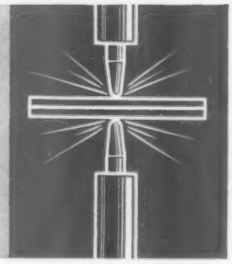
P R MALLORY & CO Inc

MALLORY MEMOS

NEWS AND TIPS ON RESISTANCE WELDING

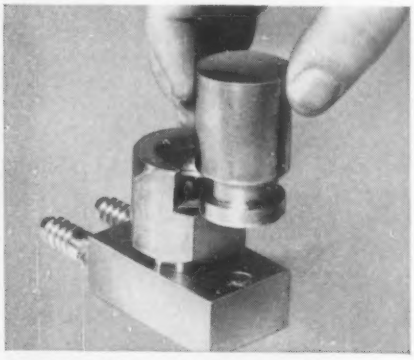
Mallory Metallurgical Company, Indianapolis 6, Indiana



Welding Hints

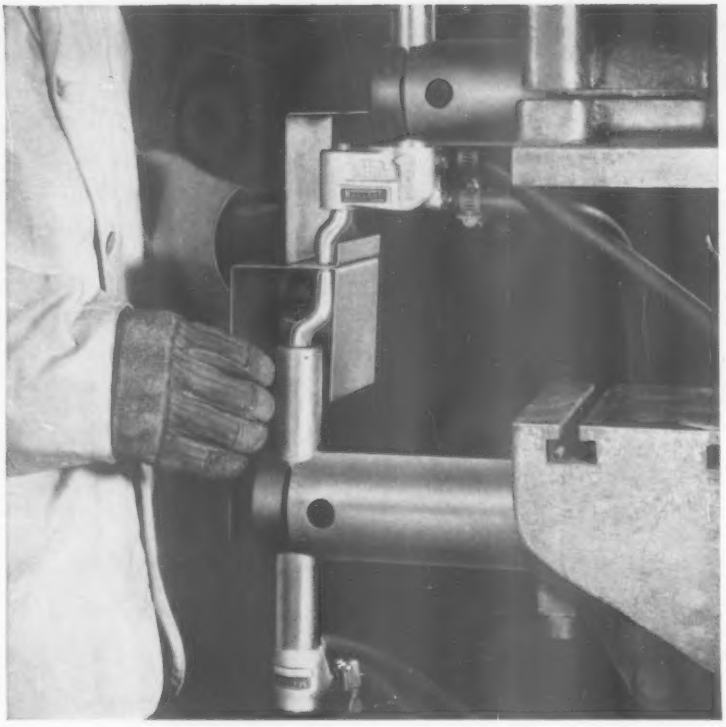
Low Inertia Holders for Welding Soft Metals

When resistance welding yellow brass, aluminum or other metals or alloys that melt abruptly and cause "burning", Mallory low inertia holders give quick spring-loaded follow-up of pressure that assures consistently good welds. Apply them to big welding machines to convert to low-pressure welding. Interchangeable springs give you wide range of welding pressures.



Nu-Twist® System Permits fast changing of electrodes

Turn a hex nut, slip out the old electrode, insert the new one, tighten the nut and you're ready to resume welding. Change-over time is only a few seconds, with the "Nu-Twist" combination of engineered electrodes, holders and adapters. Get a copy of our bulletin from your Mallory distributor.



Another "special" set-up solved with standard Mallory components

This welding set-up just *looks* difficult. Actually it's just one of thousands that you can work out with standard Mallory electrodes and holders that you can get from a Mallory distributor near you.

The upper holder is a 500 Series Heavy Duty offset water cooled holder, with a double bend Mallory 3 electrode with pointed nose. The lower holder is a 300 Series "Premium" Heavy Duty water cooled holder, also fitted with a double bend Mallory 3 electrode. All parts are standard, all readily available, all economically priced.

You'll save yourself time, money and worry, by letting your Mallory welding distributor solve your "special" set-ups with the hundreds of standard Mallory holders and electrodes he carries in stock. You'll get more welds per dollar, too. Mallory welding products are precision-made from specially developed Mallory alloys . . . incorporate unique designs which assure cool operation, long production between dressings.

MALLORY RESISTANCE WELDING PRODUCTS ARE AVAILABLE FROM AUTHORIZED DISTRIBUTORS LOCATED IN ALL PRINCIPAL CITIES

For More Information Circle No. 52 on Reader Service Card.

SPECIAL REPORT

Good design means faster low cost resistance welding

says **SIMON FISHER**, *president, Resistance Welder Manufacturers' Association*

ABOUT THE AUTHOR:

Mr. Fisher is president and general manager of National Electric Welding Machines Co., Bay City, Michigan, having served in various capacities in testing, service, sales, engineering, and management since 1935. He also worked for Ford Motor Company, General Electric Co., and Commonwealth and Southern Co. Mr. Fisher is a graduate of Antioch College with a degree in electrical engineering.

DESIGN FLEXIBILITY is a major reason for using the resistance welding processes. Spot welding replaces rivets. Seam welding gives leaktight joints. Projection welding is used for the high speed joining of metal parts. Flash or butt welds make joints as strong as the structural members they join.

Quality is another reason for using the resistance welding processes. They lend themselves to very consistent and repetitive accuracy so that appearance can be uniformly maintained. By choosing the proper method of resistance welding, automobiles, appliances, containers, and other products can be welded by techniques that show minimum distortion and discoloration and require no subsequent metal finishing.

The design engineer has considerable latitude in choosing the particular type of resistance welding most suitable for his production requirements. He has available resistance welders designed for a very wide range of work sizes, welders that are easily adjustable by means of electrical or pressure controls.

The reduction of costs is undoubtedly the major single factor that influences the choice of resistance welding. The resistance welding processes are a fast means of joining. The welds are usually made in fractions of a second without the addition of any extra material, flux, or protective atmosphere.

Once resistance welders have been set up for production, they require a minimum of operator skill. This usually means pressing a start button and sometimes feeding of parts. Because resistance welding lends itself admirably to automation or automatic equipment, labor can be reduced to merely watching the machines operate and to automatic feeding of parts.

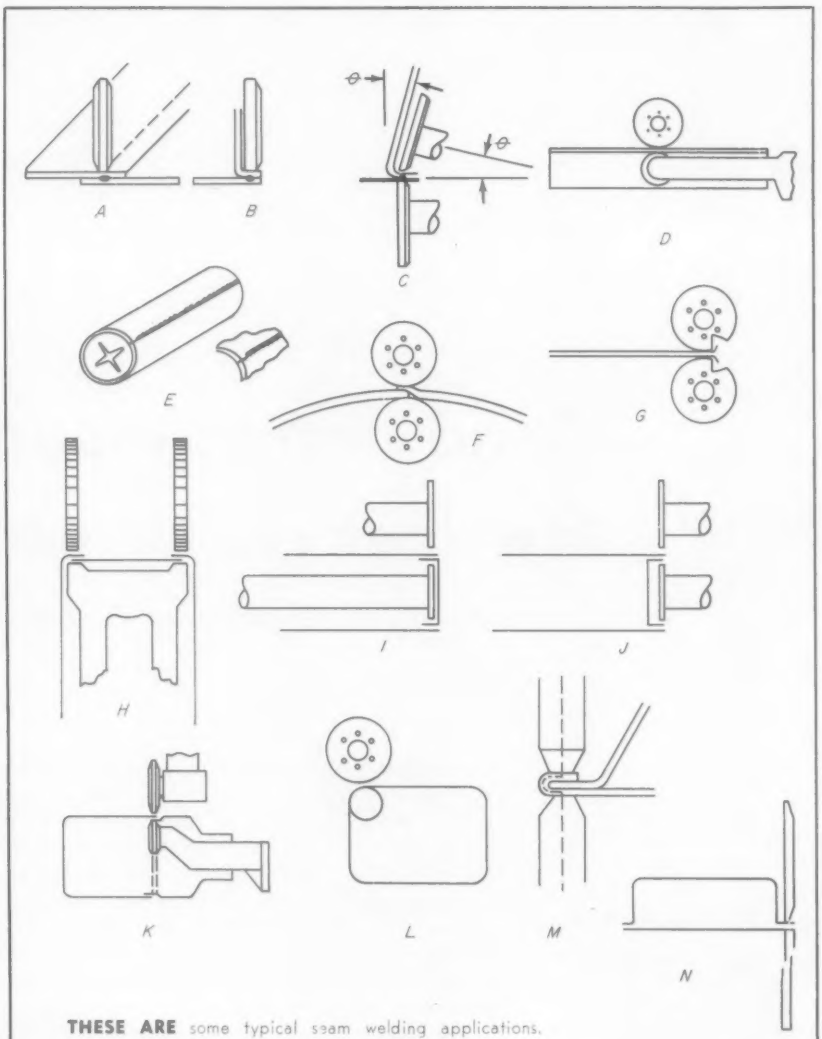
The use of multi-spot welders has greatly increased production. Many machines now in use make up to 300 spot welds in a few seconds. One of the major jobs in using resistance welding is designing and building work handling equipment to keep pace with welding operation.

Resistance welding is widely associated with the manufacture of high production metal parts and has added greatly to our national wealth in the terms of consumer goods. The manufacturing of automobiles and appliances represent outstanding achievements in this area.

Daily, resistance welding developments are increasing production, reducing costs, and improving quality.

Discussions on designing for resistance welding which follow were prepared with the cooperation of the RWMA.

Designing for seam welding



THESE ARE some typical seam welding applications.

A SEAM WELD is basically a series of overlapping spot welds so good design practices are similar to those used in spot welding.

However, electrode clearance is more important because of the size and shape of the seam welding electrode.

SEAM WELDING MACHINES

Most seam welding is done on two types of standard machines. One is a circular machine in which the plane of rotation of the welding wheels is at right angles to the throat of the machine. The other is a longitudinal machine. The welding wheels rotate parallel to the throat of the machine.

SEAM WELDING APPLICATIONS

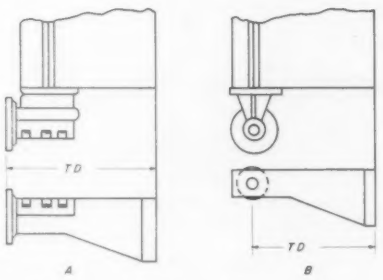
The accompanying chart shows a number of typical seam welding applications.

The simplest of these is a plain lap weld (*A*). Use the circular machine if the length of the weld is long and the width short. Use the longitudinal machine if the weld length is short and the width considerable (as in joining the ends of a circled band or shell). Keep the throat depth to a minimum, as in spot welding.

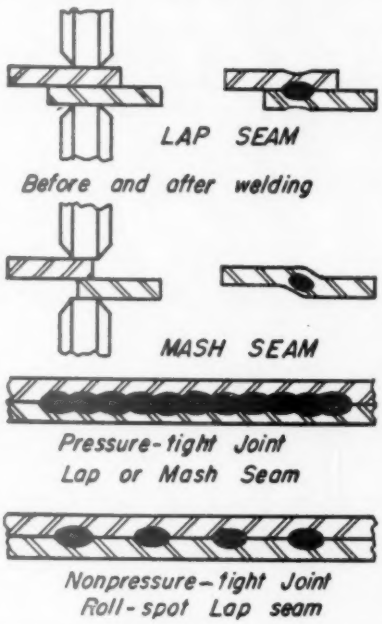
A variation of condition *A* is shown in *B*. Joints like this one usually must be made on a circular machine.

C shows a variation in which the flange is turned back at an acute angle. In this case the upper shaft must be placed at the same angle as the work. This angle cannot be greater than 10° and should not exceed 6°. Either upper or lower shafts—or both—may be set at this angle.

D shows a typical longitudinal joint used in all types of containers. If production is high, the throat depth of the machine should slightly exceed the length of the seam. If the seam length exceeds 30 inches, it is



THERE ARE two types of seam welders.



TYPES of seam welded joints.

generally advisable to weld halfway in, turn the work around, and finish the weld from the other end.

Most products that have a longitudinal weld also have a circular one. This is shown in *E*. The longitudinal weld will leave a step or hump (*F*) and equals the thickness of the stock. When the circular seam is made, there will be a slight gap at this point which must be closed by an arc or gas weld. Furthermore, unless both wheels are power driven, they may skid and not be able to ride over this hump.

There are two ways to overcome this. The best is to coin this double thickness down to a single thickness over the area where the circular weld crosses it. Another method is to notch out the overlap before making the longitudinal weld (*E*). However, this is not too satisfactory. It is difficult to control and almost always results in leakers.

Where it is necessary to seam weld close to a turned up flange or side at right angle to the weld, a pie or segment-type wheel (*G*) must be used. Obviously the height of the side or flange cannot exceed the possible depth of the segment in the wheel. For such a condition, a special fixture setup similar to that shown in *H* will be necessary. Here, which could be the welding of the bottom to a box, the sides are placed over the fixture, then the two welding wheels weld the two seams simultaneously in series. Note that the welding wheels contact the side flanges, forcing all the welding current through the welds. If the bottom piece were placed on top so as to contact the weld wheels, part of the current would pass through the bottom, by-passing the weld.

MORE DESIGN PROBLEMS

I shows welding an in-turned bottom or end into a cylindrical container. Note that the lower arm must reach completely through the cylinder. This is poor design. First, it increases the cost of the machine and requires a higher kolovolt-ampere demand. Second, most containers are relatively small in diameter. This poses a problem in providing a sufficiently rigid and strong lower arm.

K shows a case where a circular weld must be made in a necked-in container. A typical example is welding the breast to the body of a milk can.

Another problem is posed in sketch *L*. Here, a flanged bottom is welded to a rectangular container. It is obvious that the corners must be round; the minimum radius of these corners is about 2 inches.

VERY POOR DESIGN

M shows a very poor and almost impossible seam welding application, such as in welding the bottom of an oil can. It will be seen the shunting effect is of major importance; the major portion of the current passes through the folded portions of the bottom, robbing the joints of sufficient current to make a satisfactory weld.

A better design is shown at *N*. Here the parts are being welded in a rotating fixture, welding the assembly in one revolution. If production warrants it, the assembly could be placed in a different type of fixture, with two welding wheels on top, making one-half revolution to complete the weld. A typical application is welding base plates to high explosive shells. • •

Designing for spot welding

THE MOST IMPORTANT conditions and rules to follow in designing for spot welding are as follows:

Electrode space: First provide for sufficient electrode space. Figure 1 (A) is the ideal condition for a spot weld. One of the sheets is turned up (B) to form a flanged joint. In this case, the flange must be wide enough to provide electrode clearance. If the electrode or holder touches the turned up flange, there will be a partial shunting of current. This weakens the weld and marks the sheet, and electrode or holder. An offset electrode (C) will help if the electrode clearance is limited.

Sometimes it is necessary to fold the flange over to form an acute angle (D). If this angle does not exceed 30° (from vertical), set the electrode holder in the horn at an angle. (Thirty degrees is the standard angle and should not be exceeded. Sometimes, an angle of 22½° is used.) Use a special electrode setup if the angle exceeds 30°.

Edge distance: The edge distance is the distance between the center of the electrode or weld to the edge of the sheet. This is dimension C in Figure 1A.

When welds are made too close to the edge, there is insufficient body to support the weld nugget. This results in cavities, metal expulsion, and weak and defective welds.

Throat depth: Dimension TD in Figure 2 repre-

text continues on page 55

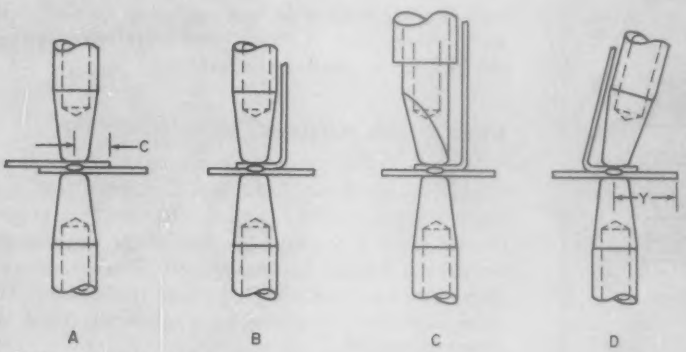


FIGURE 1: Typical lap-spot welds.

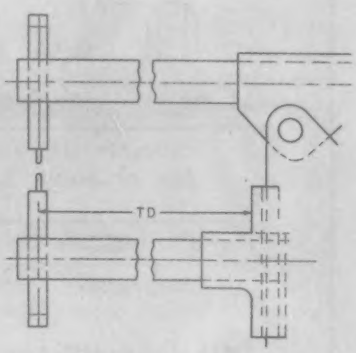
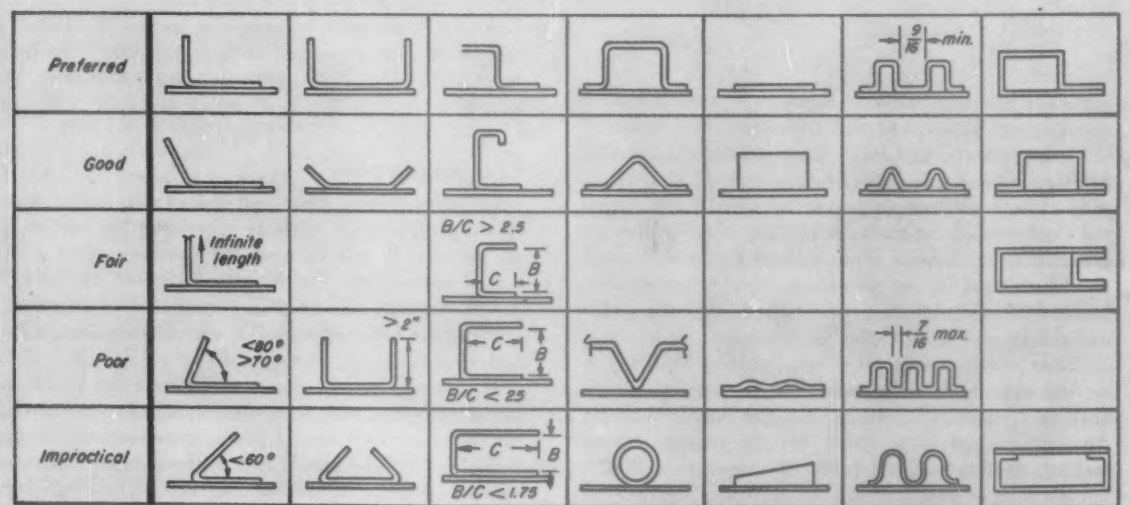


FIGURE 2: Throat depth of spot welder



GOOD AND BAD accessibility for spot welding is illustrated here.

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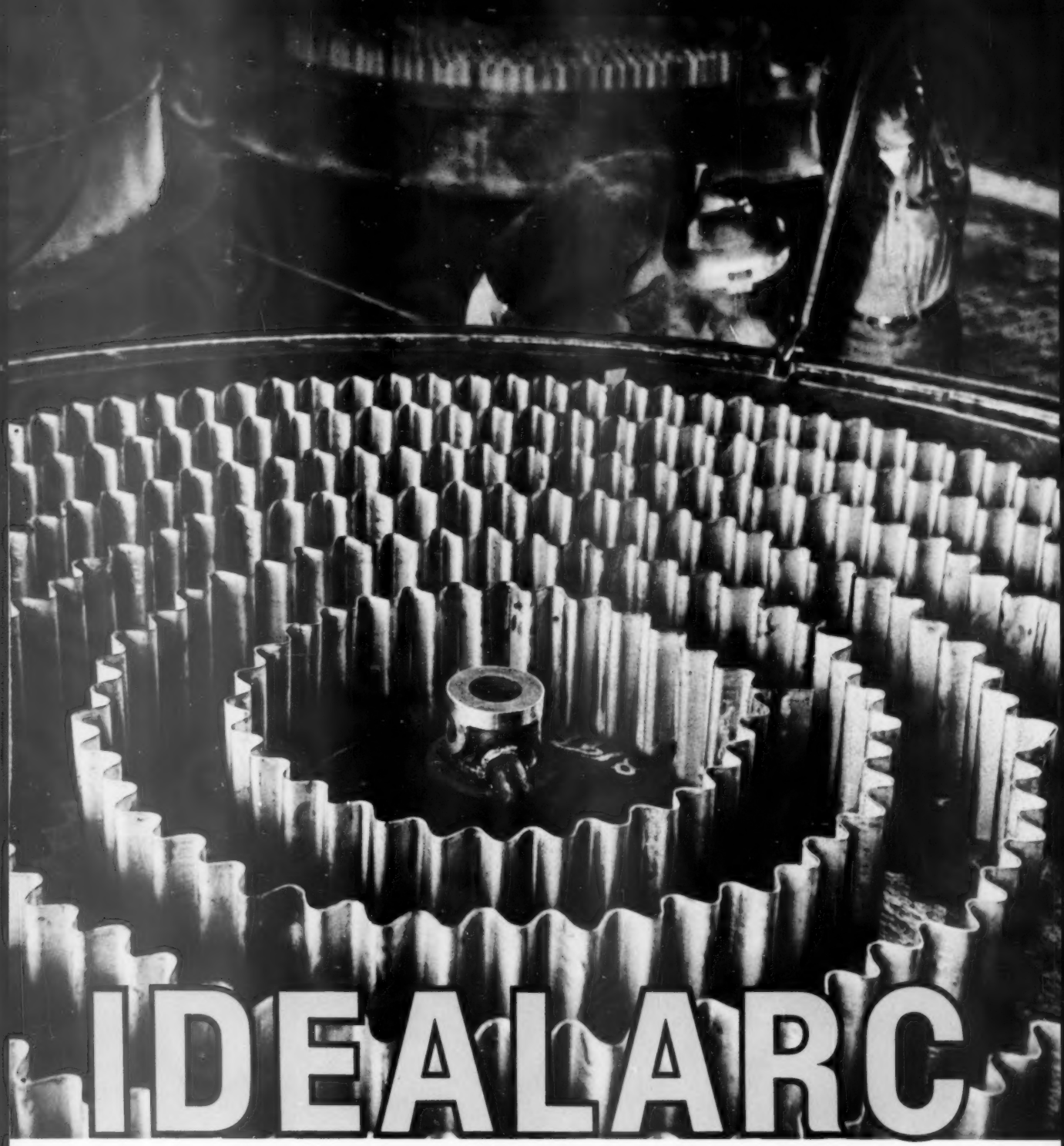

IDEALARC

Right at this moment, you may have a welding problem. The ideal solution is a welder which will most profitably perform the immediate task, and which will also permit you to change your operations to meet future market conditions or accommodate newly developed electrodes. On the next few pages, we propose to show that Lincoln Idealarc Welders are best suited to accomplish precisely these objectives.

These are Lincoln IDEALARCS on the job

Lincoln *Idealarc TM*, AC/DC machine is excellent for shipyard use. Most vertical and out-of-position welding takes DC electrodes, thus, the obvious need for DC current. Downhand welding, on the other hand, is usually done with iron-powder electrodes which take AC. Just a flip of the switch instantly changes current, lets the weldor select the correct current for each electrode, each job.

Here, straight AC *Idealarc TM's* predominate since this shop has been set up to operate on long production runs using AC electrodes. For this purpose, no other machine made will provide better service at lower initial or operating cost. Optional accessories let you tailor-make your TM for your particular operations.

In the Lincoln family of heavy-duty Idealarcs, there are three machines, the TM, the TIG and the R3M. R3M uses DC electrodes only; the TM, both AC and DC electrodes; and the TIG, any stick electrode or the inert gas process. One or more of these machines will handle every conceivable manual welding chore that could arise. And do it profitably!

Idealarc TM's are available in two different models, a straight AC and an AC/DC. When you select the AC/DC version, you can change from one current type to the other just by flipping a switch—it's that fast. Thus, you can take full advantage of those rods which work best on DC, or use the more recently developed electrodes which frequently require AC. Obviously, with the competitive demands for increased speeds and top electrode performance, the ability to select either AC or DC at a moment's notice gets more important each year. Because this is done so easily with the *Idealarc TM*, it is the favorite of many production men today.

Some work is, on the other hand, highly repetitive year-in, year-out. It may require either AC or DC. Here, low-cost, long-lasting equipment may be more important than machine flexibility. If yours is this kind of an operation, the *Idealarc TM* AC-model cannot be beaten for lowest cost, and the *Idealarc R3M* is the finest available three-phase DC-rectifier. It draws balanced current from the power line as do motor generator sets, but R3M's have the advantage of being essentially quiet. Further, when spatter control is important, such as on many stainless steel jobs, the R3M will give somewhat less spatter.

With the increased use of stainless steel, aluminum, magnesium and other special metals in modern fabrication, inert gas welding is becoming more important every day. To provide you with a welder which will perform TIG welding tasks and still be useful on normal stick welding jobs that make up the bulk of most shop work, Lincoln has developed the *Idealarc TIG*. With it, you can get both AC and DC welding current plus high-frequency, gas and water controls. In the TIG welder, then, you have the most complete, most versatile machine made.

LINCOLN WELDERS

Each Idealarc machine—as the name implies—is ideal for solving a variety of welding problems. To each you can add optional accessories such as remote current or polarity controls, even power packs to permit the largest sizes to be used as power sources for submerged arc welding. Thus you can select the model and optional accessories to suit immediate and foreseeable needs. You pay for no more. Why not let your Lincoln field engineer, a specialist in welding, explain the capabilities of each of these machines soon.

Shops like this one which consistently weld with and have need for a great many DC machines, may well wish to take advantage of the quiet operation of the *Idealarc R3M*, DC welder. Their highly efficient silicon rectifiers won't age or deteriorate. Special circuitry provides exceptionally good protection against overloads.

Here the *Idealarc TIG* is used as power source for inert gas process. Machine lets you weld with AC- or DC-electrodes, too. Factory-equipped with high-frequency, gas and water controls plus many other optional features. However, you select only those you need, and save the expense of buying unnecessary capabilities.

LINCOLN WELDERS

IDEALARC TIG's
AC or DC Inert Gas Plus AC or AC/DC

Idealarc TIG's are available in 300-amp models, both AC and AC/DC, with or without high-frequency, gas and water controls. All are NEMA rated machines. Ask Lincoln sales engineer for Bulletin 4608.1.

IDEALARC TM's
AC and AC/DC Welders

Idealarc TM's are furnished in 300, 400, 500 and 650-amp models in both straight AC and AC/DC models. Each is a NEMA rated machine. Want more information? Ask for Bulletin 4607.1 which describes 300-amp and larger sizes. 250-amp Idealarc described in Bulletin 4606.1.

IDEALARC R3M's
Three-Phase, Rectifier Welders

Idealarc R3M's are built in 300, 400, 500 and 650-amp sizes. Each is NEMA rated. Need details? Ask your Lincoln specialist for Bulletin 4609.1. Or write to:

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sents the throat depth of the machine. Obviously, dimension Y in Figure 1D must be less than the throat depth of the machine on which the weld is to be made. Due to the very considerable current losses incurred in deep throat machines, hold the throat depth to a minimum. When this cannot be done, or when it becomes impractical, use indirect or series welds.

Contacting overlap: The minimum width of overlap of the two sheets is twice the minimum edge distance. This is true for both spot and seam welding. However, mash seam welds are made with a contacting overlap of about one-half the stock thickness.

Weld strength: Standards for spot weld shear and tensile strength have been published for various materials. It is impossible to get a spot or seam welded joint with 100 percent shear or tensile strength. In the case of a seam weld, and even under the best of conditions, there is a weld indentation which reduces the effective stock thickness at the edge of the seam. Additional paralleling seams cannot improve this condition. The maximum strength from any lap welded joint is about 90 percent of the strength of the parent metal.

Selection of equipment: The first choice is between stationary or portable equipment. The principal factor is the product itself. If it is bulky and heavy, bring the machine to the work rather than bring the work to a stationary machine. Or, if the work has several parts that must be located and assembled in a jig or fixture, then portable equipment, or guns, should be used. Use special multiple electrode machines when production will warrant their use.

PORTABLE GUNS ARE VERSATILE

Welding guns used as portable welders or in multiple electrode machines are better adapted to special designs. They permit you to reach in to difficult spot locations.

Because portable guns must be maneuverable, they are usually designed for a given job. This results in an almost endless variety of special designs and electrode combinations.

Surface conditions: The quality of the finished product depends upon the type of material used. It should be clean, and free from mill scale, rust, dirt, grease, oil, or paint.

Fit-up of parts: When stampings or forgings are welded, the component parts should fit properly before welding. Any pressure or force needed to force the parts into the final fit will detract from the welding force. This results in weakened, inferior, or inconsistent welds. This is not necessarily the case in certain machines in which provision is made for a fit-up of this kind. For this reason, it is necessary to give special attention to manufacturing tolerances of the component parts.

MISFIT IS HARD TO CORRECT

Some designers think the welding operation can correct the misfit of component parts. This is true to a certain extent in flash welding, but it is seldom true on spot or seam welding. • •

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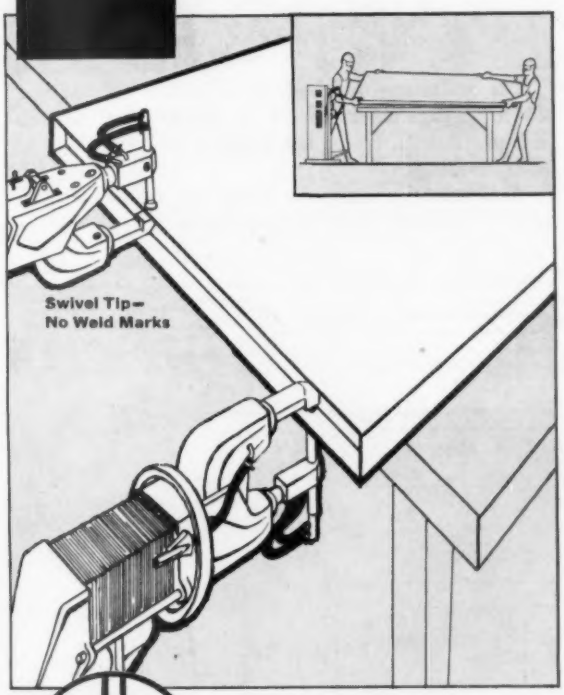

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Designing for projection welding

IF YOU TAKE CARE in designing parts to be projection welded, you'll get satisfactory and economical results. Theoretically, projections may be of almost unlimited variety. In practice, some have proven to be better than others.

Always try to have a point or line contact from which the weld may grow. Ordinarily, the weld grows from the center outward so the best projection is the round or button type. To obtain the vitally needed heat balance (equal distribution of weight between the two parts being joined), you often have to use ribs or elongated projections on extremely heavy sections.

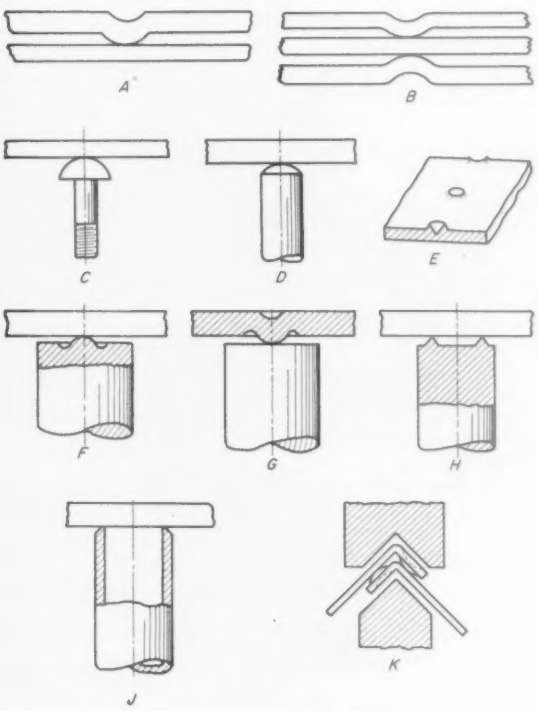
Use a button or spherical projection for welding 24- to 13-gage sheet. For 12- to 5-gage sheet use conical projections. Never use partially sheared plugs or semipunchings.

As a rule, the upset of a prick is a suitable projection for welding fairly heavy pieces to very thin sheet (under 24 gage). Although projection welding has been done on sheets under 24 gage, it isn't recommended for sheets under 0.015-inch thick. The weld is too weak.

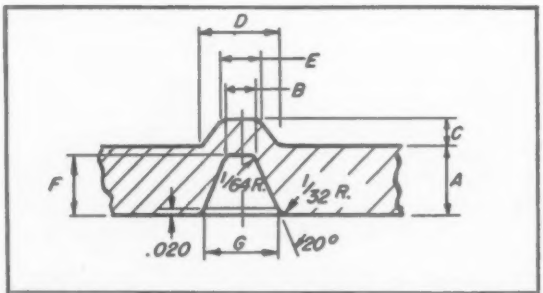
When projections are made on formed pieces, and the contact surface to which it mates is not flat, it is usually desirable to use elongated projections. Elongated projections can also be used to provide for welding corners of sheet. Some times you can shear sheet ends to leave projections of suitable shape.

Projections for gas- and water-tight joints are normally made with ring or annular embossed projections. Annular projections can also be used for attaching large circular parts or bosses.

Your aim is proper fusion temperature at the same instant in the two parts being welded. For parts of unequal thickness, make the projections in the heavier piece. A projection in the thin piece will burn off before the heavy piece gets to fusion temperature.

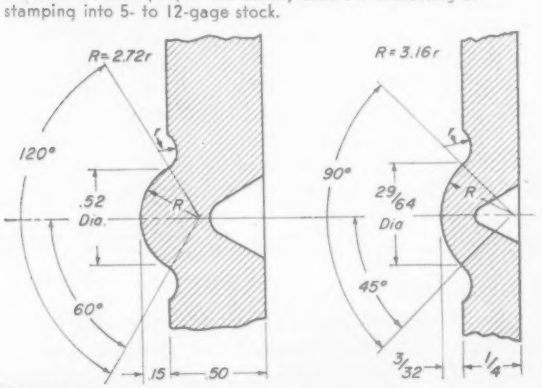


TYPICAL PROJECTION WELDS: A shows the simplest type. **B** shows projection welding three thicknesses. **C** shows how a standard round head machine screw can be readily welded to a plate. At **D** a rounded bar or rod is welded to a plate. **E** shows projections made with a prick punch in a heavy sheet. **F** shows a preferred method of preparing the end of a bar or rod. The same projection may be placed in the plate as shown at **G**, and welded to a bar or other plate. At **H** an annular ring is machined into the bar. **J** shows a method of welding a tube to a plate. **K** shows a projection welded corner joint with projections in each piece.



GAGE	A	B	C	D	E	F	G
5	.218	.080	.075	.210	.100	.200	.220
6	.2031	.080	.070	.203	.094	.182	.206
7	.1875	.080	.070	.203	.094	.166	.185
8	.1718	.080	.060	.190	.080	.138	.166
9	.1562	.080	.060	.172	.080	.122	.155
10	.1406	.080	.060	.172	.080	.110	.145
11	.125	.080	.055	.172	.080	.100	.138
12	.1093	.080	.055	.172	.080	.090	.131

DESIGN of cone projections usually used for embossing or stamping into 5- to 12-gage stock.



SPECIAL TYPE of projection is used for heavy plate where no flash and close fit of parts is desired.

Where the ratio of thicknesses is greater than 3 to 1 it is usually more practical to place the projection in the thinner. When you can form projections in only the lighter part, you sometimes get the heat balance by backing up the thin part with hard electrode material with low conductivity. When joining unlike metals, always form the projections in the part of the metal with the higher electrical conductivity, barring special conditions.

Sometimes you can machine, cast, forge, or head projections during production, avoiding stamped projections. Integral projections, as these are called, can be of an almost unlimited variety. Machined projections may be of the annular, pyramid, elongated, or spherical shapes, or of special design. Special annular projections or bevel forms are used to weld tubing. The preferred type yields minimum flash on inside of tubing. Where tubing is to be welded to a flat surface and minimum flash is desirable outside, the bevel is usually placed on the inside; solid parts are handled similarly.

On accurate, heavy assemblies in which no flash is desired between mating parts after welding, manufacturers have used a special projection. The volume of the depression around the projection is made about 70 percent of the volume of the spherical portion above the surface of the plate.

For welding to sheet $\frac{1}{8}$-inch and under, use multiple projections. They give best results with least current, pressure, and time. Three projections as far from the axis as possible radially and equally spaced give best results. In using multiple projections, remember you need good contact on all projections with three in one group. Obviously, with up to three projections, slight variations in height would do no harm. With more than three, however, you have to hold very close tolerances of the projection or you'll have trouble getting them all to collapse at once.

Where multiple welds are used keep the distance between projection to not less than twice the projection diameter. Overlap straight welds at least the same amount, or preferably more. Design the weld buttons so they're centered in the overlap.

Electrode contact on the parts should extend at least 5 times the projection diameter in all directions from the weld to assure uniform heat distribution. To simplify the welding of contoured parts, keep the area immediately surrounding projection simple and free from complicated contours.

You can weld all metals or combinations of metals that you can spot or seam weld. Some, however, are difficult or impossible to upset in welding and some require preheat and postheat treatment. That makes them unsatisfactory for projection welding. Again, some metals are not strong enough to support a projection. Brasses in general and copper are undesirable for this reason. Aluminum is only partly successful, best with extruded parts.

The most satisfactory metals for projection welding are low carbon steel, naval brass, Monel, and certain stainless steels (Types 309, 310, 316, 317, 321, 347 and 349).

When joining dissimilar metals, make projections in the metal with the highest conductivity. • •

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Designing for flash welding

A FLASH WELD is the only type of resistance weld that can be made equal to or stronger than the parent metals they join. For this reason, and also because no end preparation is necessary, it is generally desirable to use a flash weld wherever a butt weld is called for. Important general principles of design for flash butt welding are:

1. Abutting sections should be identical in size and shape or nearly so.

2. The designer should work closely with the production department to be sure allowance for upset is consistent with welding techniques that will produce good welds.

3. Clean and tightly fitting surfaces are not necessary for flash butt welding.

4. In all resistance butt welding operations it is desirable to specify clean, smooth, and uniform surfaces for die contact, to avoid die burns on the stock and to get maximum die life.

5. Allowance should be made for possible modification of properties due to metallurgical changes. The weld zone in flash butt welded air-hardenable steel parts is hard and of low ductility unless subsequent heat treatment is used. Also, strength properties in the parent metal due to cold working will generally be lowered by welding.

6. Parts design should be such that the force exerted by the welder and the resisting forces of the work pieces are parallel.

7. Shape of sections to be welded should permit holding them in alignment during the application of pressure and sufficient amount of surface must be provided for clamping die contact.

8. Provision should be made wherever possible, to back up the work pieces and thus absorb the upset reaction in these back-ups, rather than having to apply enough clamping pressure to hold the work in the clamps by friction.

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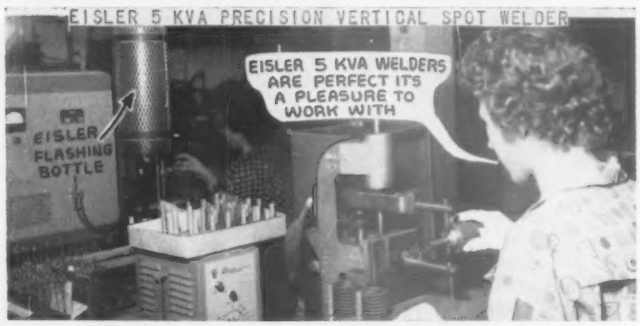
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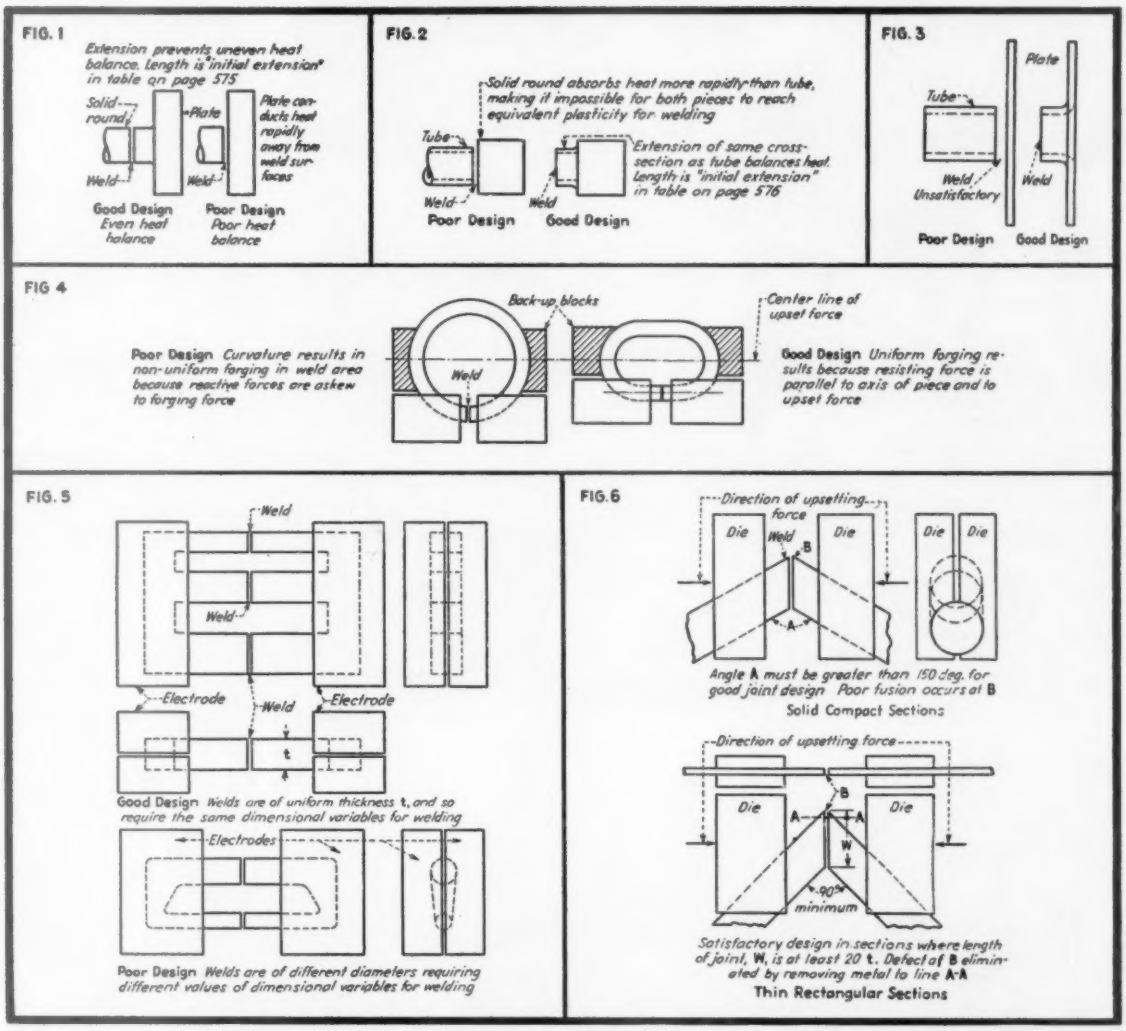
FIG. 1
Extension prevents uneven heat balance. Length is "initial extension" in table on page 575
Solid round
Plate
Plate conducts heat rapidly away from weld surfaces
Weld
Weld
Good Design Even heat balance
Poor Design Poor heat balance
FIG. 2
Solid round absorbs heat more rapidly than tube, making it impossible for both pieces to reach equivalent plasticity for welding
Tube
Extension of same cross-section as tube balances heat. Length is "initial extension" in table on page 576
Weld
Weld
Poor Design
Good Design
FIG. 3
Plate
Tube
Weld Unsatisfactory
Weld
Poor Design
Good Design
FIG 4
Back-up blocks
Center line of upset force
Weld
Poor Design Curvature results in non-uniform forging in weld area because reactive forces are askew to forging force
Good Design Uniform forging results because resisting force is parallel to axis of piece and to upset force
FIG. 5
Weld
Weld
Electrode
Weld
Electrode
t
Good Design Welds are of uniform thickness t, and so require the same dimensional variables for welding
Electrodes
Poor Design Welds are of different diameters requiring different values of dimensional variables for welding
FIG. 6
Direction of upsetting force
Die
Weld
B
Die
Die
Die
A
Angle A must be greater than 150 deg. for good joint design Poor fusion occurs at B
Solid Compact Sections
Direction of upsetting force
Die
B
Die
A
A
W
90° minimum
Satisfactory design in sections where length of joint, W, is at least 20 t. Defect of B eliminated by removing metal to line A-A
Thin Rectangular Sections

Flash welding designs: Good and bad

Figure 1: Solid section joined to solid section.

Figure 2: Tube joined to solid section. Typical aircraft structural parts of this type are made of tubing and forgings. Two tubes having same inside diameter, but different outside diameters make same general type of joint. If diameters are unbalanced more than recommended, the larger tube is machined to match smaller.

Figure 3: Plate joined to tube of equal wall thickness. This is practical when part thicknesses differ no more than is recommended. If difference is too great, another operation can be used to match the two sections within recommended maximum deviation.

Figure 4: In welding a ring or cylinder having a large ratio of circumference to thickness (150 to 1), it is customary to straighten a section long enough for clamps. This reduces die maintenance and allows interchangeability of electrodes. Rings or cylinders are made circular after welding the ends or edges together.

Figure 5: Multiple flash-butt welds between elements of same thickness, but not necessarily same area, are practical if areas vary less than 5 to 1. Compromise selection lessens overall weld quality. Normally, the welding of two sets of pieces simultaneously is not recommended unless pieces are of the same section and can be aligned independently.

Figure 6: Angle welds have inherently less than optimum quality since line of application of upset force is not parallel to center line of work pieces. However, flat rectangular sections are often joined at 90°. In parts of triangular section with a small apex angle at B, metal must be removed if the joint is to be highly stressed.

At Triangle Sheet Metal Works, Inc., Tips made of New Copper-Zirconium Alloy Minimize Electrode Pickup, Reduce Dressing, and Triple Electrode Service Life

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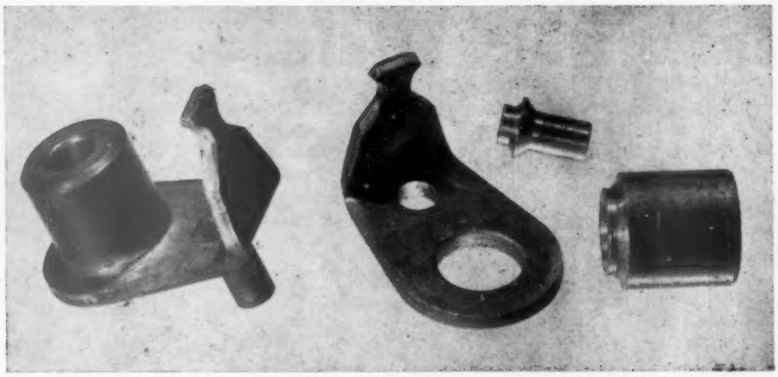
How good design can cut costs



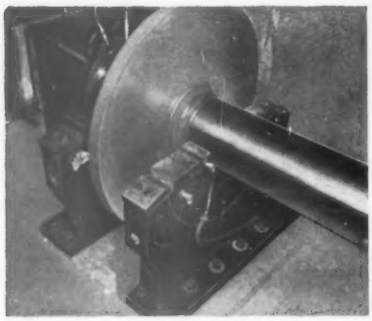
Redesign for projection welding made a stronger, cheaper electric shift-lever for a two-speed industrial truck axle. The assembly is an L-shaped stamping to which a machined hub and actuating pin are joined. Both the hub and pin are subjected to heavy loads.

The projection welded lever met all these requirements:

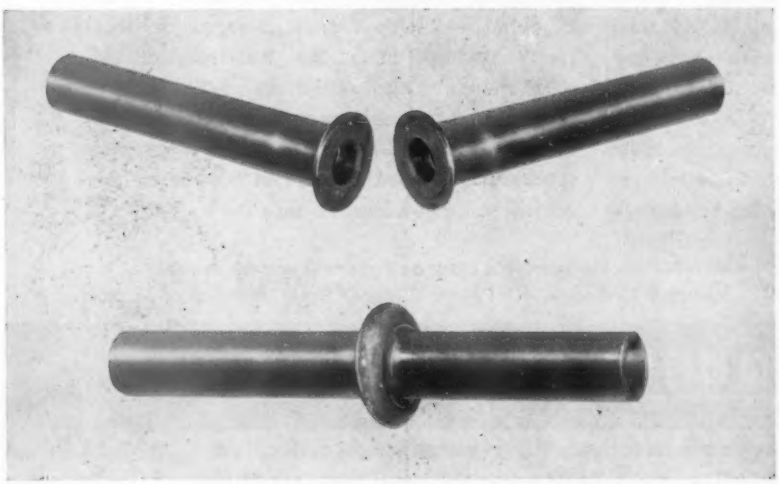
- It stood up under road tests that loosened brazed joints that were used originally.
- It was competitive to furnace brazing which had been selected as the most economical way to get volume production.
- It maintained good alignment between the cylindrical hub and the closed end of the stamping, provided a close tolerance on the hub's inside diameter, and smooth bearing surfaces at the bases of the hub and actuating pin.

The redesign resulted in a substantial reduction in overall cost. Modification required was minor. It consisted of lengthening shoulders which fit into the stamping and adding chamfers or fillets at inside corners of shoulders. Electrical resistance is provided by line contact between tapered fillets and rims of holes in the stamping. Only additional operation required after welding is reaming the inside diameter of the hub. This is required because forging pressure has a mushrooming effect.

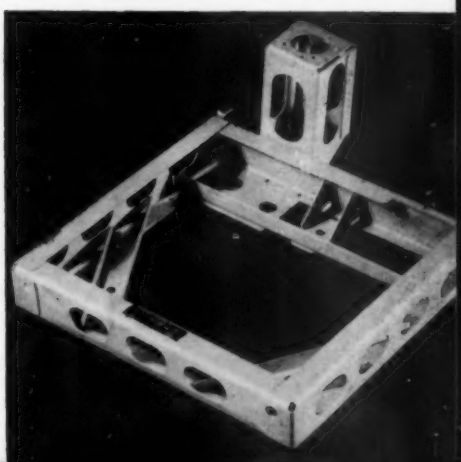
Spotweld Division of Otto Konigslow Mfg. Co., Cleveland, did the redesign for the Axle Division of Eaton Mfg. Co., Cleveland.



Both flash butt welding and pressure welding are widely used by Cleveland Pneumatic Tool Co., a Division of Cleveland Pneumatic Industries, Inc., to produce welded joints with exceptional uniformity. Versatile flash butt welder (left) joins low alloy steel tubular shaft to high temperature alloy disc. Pressure welding machine makes upset in alloy steel tube (below) to produce machinable flanges.



Spot welding was the simplest way to build this rigid frame, 26-ounce aluminum assembly used in navy aircraft to support cryogenic equipment. Fusion welding the base would have caused distortion, burn through, and required expensive fixtures. Spotweld Division of Otto Konigslow Mfg. Co., Cleveland, made 400 of these bases from 11 different pieces of blanked and/or formed 6061-T4 and 6061-T6 aluminum 1/16-inch thick. Welding was done in a simple, inexpensive fixture on a 90 KVA 3-phase spot welder using Class 1 electrodes. Lightening holes provide access for electrodes. Bases are subjected to severe vibration tests.



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Control standards are up-to-date

THE RESISTANCE WELDING INDUSTRY—control makers, welding machine manufacturers, and users—are on excellent speaking terms. They have had a common language since NEMA (National Electrical Manufacturers Association) revised their standards on Resistance Welding Control in July, 1960. The standards are in a 94-page publication, IC 2-1960, released by NEMA last September.

Until September, there wasn't complete understanding between the three elements of the industry. The standards were behind because controls had progressed so rapidly. Users weren't aware that certain controls were available—unless they stumbled on them.

Today's standards mirror the latest thinking and developments in controls. Language, designations, and definitions are the same for a given control, any make. And everybody benefits: The user (mostly), the welding machine manufacturer, and the control maker.

The NEMA standards eliminate misunderstanding between the manufacturer and buyer. They help the buyer select and obtain the right control for his job. Standards define controls with reference to one or more of the following: Nomenclature, composition, construction, dimensions, tolerances, safety, how it works, performance, quality, rating, testing, and service.

There are two classes of NEMA standards: One which covers standard commercial products. The second, a suggested sound engineering approach for new development.

This report highlights the new NEMA standards on resistance welding controls. For complete information on resistance welding control standards write: NEMA, 155 East 44th Street, New York 17, N. Y.

Text continues on page 66

NEW DEFINITIONS

CONTROLS

Dual Gun Dual Sequence Control: Provides for initiating control from a second gun with the switching of the solenoid valve circuit to the gun. The initiation circuits are interlocked to prevent operation of the unselected gun while the selected initiation circuit is closed. This control has a new set of separate adjustments for squeeze, weld, hold, and off. When used with heat control, control has a separate heat adjuster.

Current Regulator: A device to maintain the rms current in the primary of a resistance welder transformer at a predetermined value or pattern of values.

Voltage Variations—Gradual and Instantaneous: Gradual voltage variation is a change in rms line voltage at a rate of *less than one percent* per second. Instantaneous voltage variation is a change in rms line voltage at a *greater* rate *than one percent* per second. Voltage changes having a duration of less than two degrees are excluded. Voltage changes are measured by comparing oscillograph records of the voltage before and after the voltage change.

Method of Initiation-Delayed Firing: Delayed initiation of the first half cycle of weld current with respect to the voltage wave in order to minimize the initial transient of magnetizing current of the welding transformer.

Inversion: As applied to an electronic frequency converter control—is the action of retarding the firing angle of the electronic power tubes near the end of a pulse in a way that the polarity of the voltage is reversed for the purpose of reducing the current to zero in a minimum amount of time.

TIMERS

Multiple Impulse (Pulsation) Weld Timer: A device for multiple impulse (pulsation) welding which controls only the heat time, the cool time, and either the weld interval or the number of heat times.

Sequence Timer: A device for controlling (1) sequence and (2) duration of any or all of the elements of a complete resistance welding cycle except that control of the weld time or heat time is excluded; however this device may also control other mechanical movements of the welding machine. Means are provided for initiating a separate weld time or multiple impulse weld timer.

Sequence Weld Timer: A device which performs the functions of a sequence timer and the functions of either a weld timer or a multiple impulse weld timer.

Function Timer: A device which controls the time interval between its initiation and the actuation of the output signal or relay contacts. Function timers can be serially connected to perform the functions of sequence weld timers as well as more complex sequences required by the welding process.

TYPES OF CONTROLS

TIMER TYPES AND TIME RANGES

Description I Timer Function II Control Features	Nonsynchronous Timer Range (1) NEMA Type No. (3)									Synchronous Precision Timer Range (1) NEMA Type No. (3)		
	1A	1B	1D(A)	1D(B)	3B	3C(4)	5B	7B	9B	1AS	1BS	1CS
I SQUEEZE					3-120	3-30	3-120	3-120	3-120			
SQUEEZE DELAY						3-30*						
INITIAL SQUEEZE						3-60*						
WELD	3-120				3-120	2-30		(5)		1-60		1-10
WELD INTERVAL		9-360					9-360		9-360			
HEAT		3-30					3-30		(6)		1-30	
COOL		3-30					3-30		(6)		1-30	
HOLD					3-60	2-30	3-60	3-60	3-60			
OFF					3-60	3-30	3-60	3-60	3-60			
FUNCTION			3-60	3-360								
II REPEAT					•	•	•	•	•			
NONREPEAT	•	•			•	•	•	•	•			
NONBEAT					•	•	•	•	•	(2)		(2)
PRESSURE SWITCH					•		•	•	•			
TWO STAGE PILOT SWITCH					(2)		(2)	(2)	(2)			
DUAL GUN DUAL SEQUENCE						(2)						
WELD SAFE			•			•						
DELAYED FIRING					(2)	•						

(1) Timer ranges in cycles, based on 60-cycle power supply. For 50-cycle power supply, multiply the ranges shown by the factor 50/60; for 25-cycle power supply, multiply by 25/60. Calibration and repetitive accuracies shall be in accordance with Part 7 except where noted.

(2) Provision shall be included for this control feature.

(3) When a sequence timer or sequence weld timer does not conform in every particular to any NEMA type designation, it shall be designated by adding the suffix "X" to the nearest NEMA type designation.

(4) Calibration and repetitive accuracies shall be in accordance with IC 2-10.02.D.

(5) Requires external weld timer type 1AS.

(6) Requires external seam weld timer type 1BS.

• Indicates control feature provided by timer.

* Select only one function marked with an asterisk.

NEMA Standard 7-13-1960.

AUXILIARY CONTROL FUNCTIONS

DESCRIPTION TIMER FUNCTION	Nonsynchronous Timer Range (2) NEMA Suffix No. (1)							Synchronous Precision Timer Range (2) NEMA Suffix No. (1)				
	U(3)	D(3)	T(3)	F(3)	P(3)	R	(4)	U(3)	D(3)	F(3)	(4)	T(3)
UP SLOPE	3-30							1-10*				
UP SLOPE								1-30*				
WELD HEAT		3-60							1-60			
WELD INTERVAL HEAT		3-180							3-180 (5)			
DOWN SLOPE		3-30							1-10*			
DOWN SLOPE									1-30*			
QUENCH			9-360									9-360 (5)
TEMPER			3-120									1-120
FORGE DELAY				3-360						0-60 *(6)		
FORGE DELAY										0-360 *(6)		
PRECOMPRESSION							3-10 (3)					
DELAY AFTER PRE-COMPRESSION							3-10 (3)					
PREHEAT					3-120							
WELD DELAY											0-3(6)	
FINAL HOLD						1-180						
INDEX						3-360						
DELAY AFTER INDEX						1-10						

(1) Auxiliary control functions are indicated by a suffix letter. When a control does not conform in every particular to any NEMA designation, it shall be designated by adding the suffix "X" to the nearest NEMA type designation.

(2) Timer ranges in cycles, based on 60-cycle power supply. For 50-cycle power supply, multiply the ranges shown by the factor 50/60; for 25-cycle power supply, multiply by 25/60. Calibration and repetitive accuracies shall be in accordance with Part 7 except where noted.

(3) Includes means to by-pass auxiliary control function.

(4) Where a letter designation does not exist, the auxiliary control function shall be described.

(5) Nonsynchronous accuracy required.

(6) 0-1 vernier is in 0.1-cycle increments.

* Select only one range marked with an asterisk.

NEMA Standard 7-13-1960.

COMBINATION CONTROLS—600 VOLTS OR LESS

I Timers II Auxiliary Control Functions III Contactors		Suffix	NONSYNCHRONOUS NEMA Type No. (1)						SYNCHRONOUS PRECISION NEMA TYPE NO. (1)				
			N1A	N1B	N1H	N2	N3	N6	S1H	S2H	S3H	S4H (3) (4)	S5H (4)
I	TYPE 1A WELD TIMER		●										
	TYPE 1B PULSATION WELD TIMER			●									
	TYPE 3B SEQUENCE WELD TIMER					●							
	TYPE 3C SEQUENCE WELD TIMER							●					
	TYPE 5B SEQUENCE WELD TIMER						●						
	TYPE 7B SEQUENCE TIMER									●			
	TYPE 9B SEQUENCE TIMER										●	●	
	TYPE 1AS SYNCHRONOUS PRECISION WELD TIMER								*	●			
	TYPE 1BS SYNCHRONOUS PRECISION SEAM WELD TIMER										●	●	●
	TYPE 1CS SYNCHRONOUS PRECISION WELD TIMER								*				
II	HEAT CONTROL	H(2)	o	o	●	o	o	o	●	●	●	●	●
	TYPE A CURRENT REGULATOR	C	*	*	*	*	*	*	*	*	*	*	
	TYPE B CURRENT REGULATOR	V	*	*	*	*	*	*	*	*	*	*	
	UP SLOPE CONTROL	U	o	o		o	o		o	o	o	o	o
	DOWN SLOPE CONTROL	D	o	o		o	o		o	o	o	o	
	QUENCH TEMPER CONTROL	T				o	o			o	o	o	
	PREHEAT CONTROL	P				o	o			o	o	o	
	HOLD-INDEX CONTROL	R										o	
	FORGE DELAY CONTROL	F				o	o			o	o	o	
III—MAGNETIC MAGNETIC WELDING CONTACTOR	50 AMPERES	0W	*	*		*	*						
	100 AMPERES	1W	*	*		*	*						
	150 AMPERES	2W	*	*		*	*						
	300 AMPERES	3W	*	*		*	*						
	600 AMPERES	4W	*	*		*	*						
	900 AMPERES	5W	*	*		*	*						
III—THYRATRON ELECTRONIC WELDING CONTACTOR	10 AMPERES	10	*	*	*	*	*		*	*	*	*	*
	25 AMPERES	25	*	*	*	*	*		*	*	*	*	*
	75 AMPERES	75	*	*	*	*	*		*	*	*	*	*
III—IGNITRON ELECTRONIC WELDING CONTACTOR	150 AMPERES	150	*	*	*	*	*		*	*	*	*	*
	600 AMPERES	600	*	*	*	*	*	*	*	*	*	*	*
	1200 AMPERES	1200	*	*	*	*	*	*	*	*	*	*	*
	2400 AMPERES	2400	*	*	*	*	*	*	*	*	*	*	*

(1) When auxiliary control function are added, a suffix letter after the numeral shall be used to describe these controls. When a combination control does not conform in every particular to any NEMA designation, it shall be designated by adding the suffix "X" to the nearest NEMA type designation.

(2) When an auxiliary control function requires heat control, the suffix denoting that auxiliary control function shall replace suffix "H". Examples are "C", "V", "U" and "D". For example N6U-600.

(3) Includes means to change from seam to multiple impulse welding.

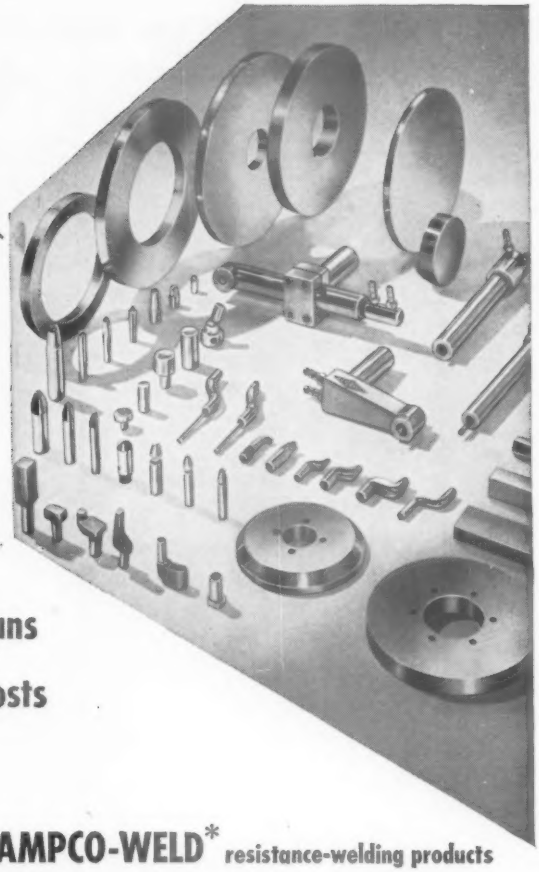
(4) Includes means to change from intermittent to continuous seam welding.

● Indicates timer types and auxiliary control functions provided in combination control.

o Provision shall be included for these auxiliary control functions. The auxiliary control functions shall be specified when required.

* In Section I under S1H, select either 1AS or 1CS timer.
In Section II, when current regulator is required, select either type A(C) or type B(V).
In Section III, select contactor required. (Magnetic contactors cannot be used with auxiliaries which involve heat control.)

NEMA Standard 7-13-1960.



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CONTROLS

continued from page 63

SINGLE-PHASE WELD CYCLE DIAGRAMS

These authorized engineering information standard diagrams (not shown) give a comprehensive picture of the factors involved in the welding process. Each diagram is keyed to an NEMA type of control. The diagrams:

1. Simple Weld Cycle (Repeat)
2. High-Speed Weld Cycle (Repeat)
3. Simple Multiple Impulse Weld Cycle (Repeat)
4. Welding Current With Slope Control
5. Weld Interval Welding Current With Slope Control
6. Complex Weld Cycle—Single Impulse
7. Complex Weld Cycle—Multiple Impulse
8. Intermittent Index Roll Spot With Complex Weld Cycle
9. Seam Weld Cycle With Slope Control—Single Impulse

In these diagrams, time, based on supply line frequency, is plotted against these related ordinates:

- *Welding Process Times*—includes time constants of the welding machine, contactors and associated equipment.
- *Current*—graphically describes all current flow during the welding cycle, including welding current and current used during the reweld or post-weld intervals.
- *Electrode Force*—the force at the electrode during the weld cycle. The time constant delays of the relays and welding machine are indicated as machine operating time.
- *Solenoid Valve Coil Voltage*—the electrical signal which controls the motion of the electrodes and is shown in time relation to the electrode force.
- *Timer Times* are referenced to electrical signals. Thus a comparison of current and solenoid valve coil voltage signals determines the timer time definitions.

CONTACTORS

Magnetic Welding Contactors: The ampere ratings of single- and double-pole magnetic welder contactors used for resistance welding are given in this standard. It gives formulae for finding ratings of 50/60 cycle contactors, and the cut-off point where

the number of operations a minute will not overheat the coil.

Isolation contactor (magnetic) is a device used in the side of the line opposite the welding contactor to isolate a single-phase welding transformer from the power supply.

Electronic Welding Contactors: Standard gives the use and make-up of single-phase electronic welding contactors of 600 volts or less. It includes rating charts from Thyratron and Ignitron tubes.

TIMER ACCURACIES

Standards for the repeat accuracy of nonsynchronous timers, and timing accuracy of synchronous precision timers are new. They give the allowable limits of control-circuit voltage variations.

FREQUENCY CONVERTOR CONTROLS

Standard gives the required features for frequency convertor controls. Tables supply control functions, auxiliary control functions, and control combinations for frequency convertors. Standards give rating, duty cycle for three-phase welding contactors.

FREQUENCY CONVERTOR WELD CYCLE DIAGRAMS

These diagrams, like the single-phase diagrams, give details of the welding process and are keyed to NEMA controls (not shown).

1. Simple Weld Cycle (Repeat)
2. Simple Weld Cycle With Weld Interval
3. Complex Weld Functions
4. Simple Seam Weld Cycle
5. Complex Seam Weld Cycle
6. Complex Weld Cycle With Weld Interval
7. Intermittent Index Roll Spot With Complex Weld Cycle And Weld Interval

ACCESSORIES

New suggested design standards for accessories: Calibration accuracy and time function of up- and down-slope controls. It gives test conditions and the calibration accuracy for nonsynchronous and precision controls.

DEFINITE APPLICATIONS

One definite application standard covers aircraft spotwelder control known as NEMA Type S2UDF (T). It provides for indicating lights to

continued on page 68

Spot Weld Easier with Tuffaloy—For Less!

NEW IDEA!
ALL ALUMINUM SPOT WELDING TIP HOLDER

It took a complete departure from previous manufacturing methods to come up with this low-cost, high quality spot welding tip holder (each is a slice of a giant aluminum extrusion). These TUFFALOY holders are corrosion resistant, carry threaded tip adapters to take the brunt of tip socket wear. For welding pressures to 1000 lbs.

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NEW IDEA!
PADDLE-TYPE HOLDER
USES NO 'T' CONNECTOR

A new design idea makes this TUFFALOY Holder more rugged, long-lived, and lower in cost to use—no tee connector is needed. Ideal for spot welding in restricted areas. TUFFALOY Socket-Type Tips (four nose types available) may be inserted on either side of the paddle.

Doc Tuffy says . . . ***be quick to use everything that improves your product or cuts your cost if you want to stay ahead of the pack . . . better get with TUFFALOY; we're coming up with the new ideas in our field.***

Write or call your nearest AIRCO or TUFFALOY distributor for more information about these holders. Also request the new TUFFALOY Catalog; it describes the new RW Taper numbering system for spot welding electrodes.

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CONTROLS

continued from page 67

signify (1) that the contactor is below maximum operating temperature and (2) when control circuit power is applied.

Another application standard covers a gun welder type of control for spot welding. It is a standard for high-speed (more than 180 spots per minute) portable gun welders. These are NEMA Types N6-600 and N6H-600. The standard covers the enclosure, disconnecting, and accuracies and control features.

A final application standard is one on the function plug-in program timer. These timers are suitable for machine sequencing and welding timing applications. Standard gives terminal arrangements and features for these NEMA Type 1D controls.

STATIC SWITCHING CONTROL DEVICES

These are suggested standards for controls that switch electrical circuits without the use of switch-contacts. Basically, the control contains magnetic amplifiers and solid-state devices. In other control devices, relays convert a single input to a coil into various outputs because its armature closes or opens contacts. By contrast, static switching control devices convert single or combination inputs into outputs by controlling the circuit impedance/or modulation. Terminology illustrates some of the operating logic functions. The same device may control different functions in the same equipment.

TYPE J CONTROLS

These are suggested standards for future design of NEMA Type J controls especially suited to mass production. The standards provide for enclosure and electrical connection, and solenoid valve control. • •

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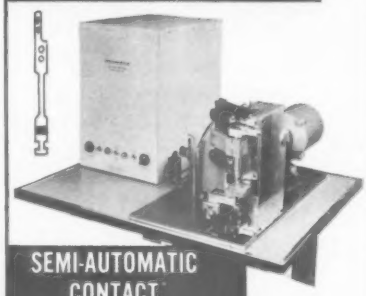

SEMI-AUTOMATIC CONTACT WELDING MACHINE

. . . which feeds, welds and cuts off contact material automatically — all in one operation. Tweezer Weld has complete design facilities for special purpose welding equipment, and facilities available for producing parts for your special needs on a production basis at our plant.

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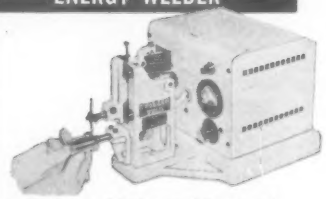

- TW5 low friction welding head
- Stored energy panel of 80 Watt second capacity
- Discharge time of 0.0008 to 0.0012 second
- Permits welding of difficult materials . . . copper, silver, tungsten, etc.
- Reliable welds without discoloration, deformation, metallurgical change
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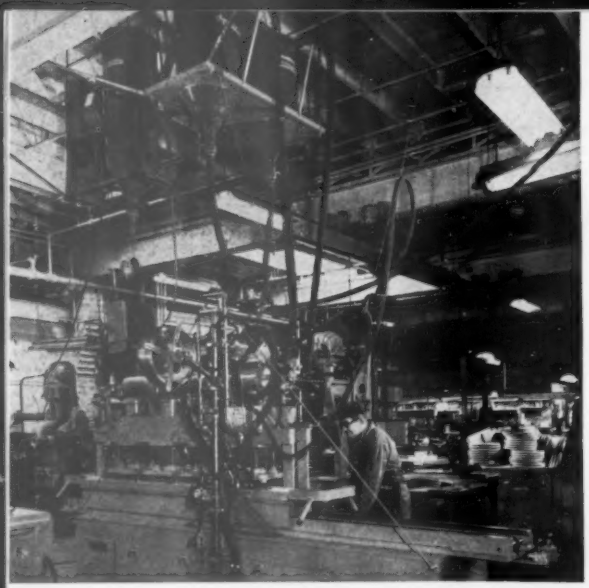
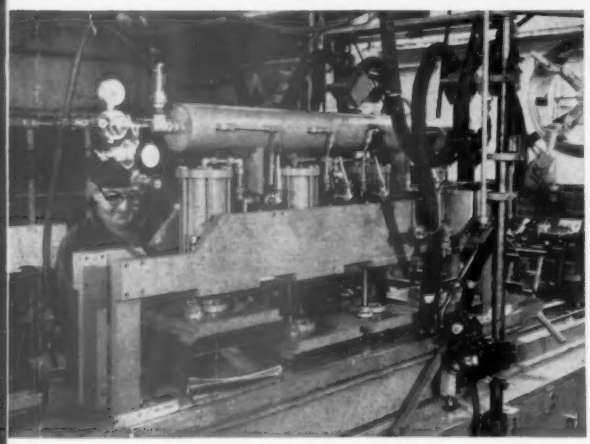
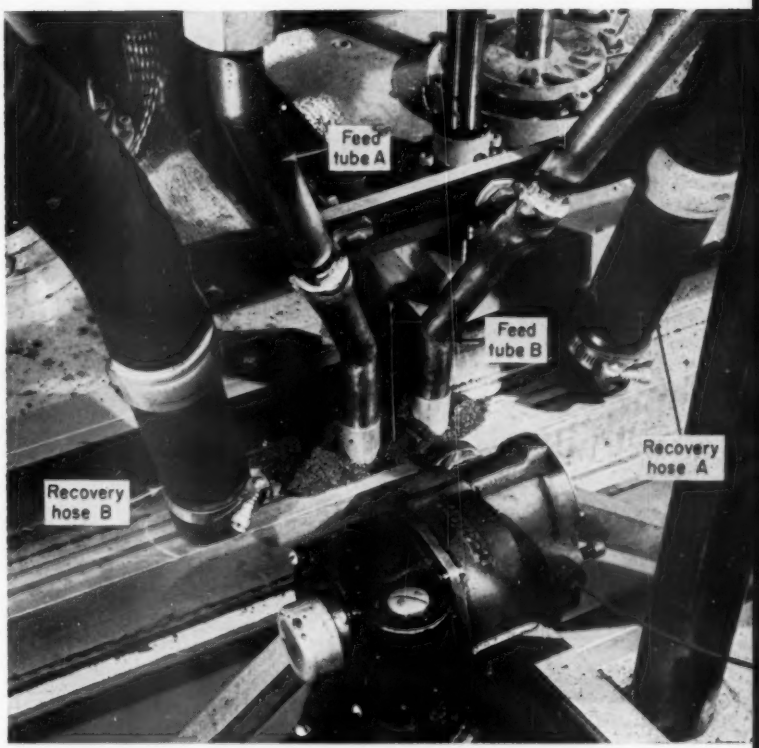
Flux recovery system and unique welder produce odd-shaped parts 250% faster







HOW IT WORKS: Tube "A" feeds flux and hose "A" recovers flux when welding in one direction. The "B" combination feeds and recovers when welding in the opposite direction. Unusual design of the installation permits two heat exchanger sections to be welded in one pass of the carriage that holds the work.

IN BRIEF: A large capacity flux recovery system and a unique automatic welding machine have teamed up to increase production of two-piece furnace heat exchanger sections from 250 to 875 units in an 8-hour day.

A UNIQUE welding machine and a large capacity flux recovery system . . . together they speed fabrication of odd-shaped parts at Henry Furnace Co., Medina, Ohio.

Henry's plant engineers designed the system. With it they can simultaneously weld both sides of a 2-piece heat exchanger section. With the automated operation, 875 units can be welded in an eight-hour day. Maximum capacity used to be only 250 a day.

The machine welds two different exchangers in one pass of the carriage. At the end of that pass, the welded exchangers are removed. New assemblies are welded on the return pass.

The flux system has one vacuum producer and two primary separator tanks. The flux flows from the primary tanks through a hose to each flux feed hopper, then through either of two feed tubes to the welder on either side of the machine. The tube used to deliver the flux to the welders is determined by the direction the carriage is traveling. Unfused flux is drawn through the proper recovery hose, also determined by the direction of the carriage movement, and returned to the primary separating tank for cleaning. Only dust-free, slag-free flux recirculates to the work. This prevents porosity in the welds.

As the carriage reaches the end of a pass, air cylinders automatically change the flux flow to the other feed tube-recovery hose combination for the return pass.

The flux system was installed above the machine because it combines flexibility, compactness, and large capacity. • •

YOU CAN'T ALWAYS WELD BY THE BOOK

Books don't pinpoint all the welding variables. Complex joints. Fussy metals. Tricky fixturing. These variables create problems, more and more of which are being solved by the utilization of *inert-gas* and *consumable-electrode* welding processes . . . combined with pioneering *experience*—the kind you find at Linde Company's Electric Welding Laboratory. Everyone claims "unmatched" research and development facilities. We have 74 fully-equipped *electric welding* stations . . . 100-plus *electric welding* specialists who spend 62% of their time on customers' problems, much of it in customers' plants, all of it free-of-charge. We are spending 3.5 million dollars every year to develop new processes, improve existing ones, and support customer-assistance programs. Here, in the past 25 years, LINDE has developed eleven major inert-gas and consumable-electrode concepts—from *submerged-arc* to *short-arc*—far more than any other manufacturer. The source of these developments—the LINDE Electric Welding Laboratory—is always ready to work for you. And since we market *every type* of inert-gas and consumable-electrode equipment, your problem receives the authoritative, yet impartial study you need.

LINDE COMPANY

UNION CARBIDE

Division of Union Carbide Corporation
270 Park Avenue, New York 17, N. Y.

"Linde" and "Union Carbide" are registered trade marks of Union Carbide Corporation.

For More Information Circle No. 79 on Reader Service Card.

For More Information Circle No. 81 on Reader Service Card.

NEW NEW NEW NEW NEW NEW NEW NEW NEW

when it

MELTS

you know the *temperature!*

NEW *Markal*

THERMOMELT

TEMPERATURE INDICATORS

With Handy Adjustable Holder

The easy modern way to determine exact working temperatures!

Just mark or stroke the surface with THERMOMELT . . . when it reaches the desired temperature, the mark liquefies. There's no guesswork, no wasted time or material . . . THERMOMELT is the quick, precise way to determine heating temperatures. Accurate to within ±1%.

A Stik For Every Temperature from 113° F. to 2000° F.

SEND TODAY for free THERMOMELT literature and pellet sample (indicate temperature desired).

ALSO AVAILABLE IN LIQUIDS AND PELLETS for inaccessible or hard-to-measure applications. Wide range of temperatures.

Made by the Manufacturers of Markal Paintstik Markers and Protective Coatings.

MARKAL CO. 3063 West Carroll Avenue • Chicago 12, Illinois

Cut the Cost of Quality!

FIND CRACKS

FAST

WITH MAGNAFLUX

Spotcheck®

DYE PENETRANT INSPECTION

EASY . . . ALL MATERIALS IN SPRAY CANS

FIRE-SAFE . . . or Chlorine-Free Formulas—SPECIFY

SPOTCHECK SAVES YOU MONEY!

Finds cracks and defects *you can't see.* Finds the cause of in-plant rejects and costly returns later. Simple, positive, fast, easy! Low-cost Spotcheck ends visual guesswork about defects open to the surface in any solid, nonporous material or part. Just spray it on from Spotcheck push-button cans. Cracks and defects open to the surface "pop" out bright red against white background. You can't miss them! Used and preferred in *thousands* of plants over other dye penetrant tests.

COMPLETE SK-3 KIT *only* **$36.00** 2 spray cans Penetrant, 2 spray cans Developer, 4 spray cans Cleaner-Dye Remover, instructions, cleaning cloth, wire brush. Steel CABINET-CARRYING CASE. Specify FIRE-SAFE or chlorine-free materials.

Prices: Continental U.S.A. only and Hawaii, F.O.B. our plant, Chicago, Illinois, plus local taxes.

Order From Your "AIRCO" DEALER — or direct

MAGNAFLUX CORPORATION

A Subsidiary of General Mills

7326 W. Ainslie Ave. • Chicago 31, Illinois

For More Information Circle No. 51 on Reader Service Card.

For More Information Circle No. 25 on Reader Service Card.

Mark 5F Ultrasonic Flaw Detector

Price for single frequency unit — **$1785.00** plus accessories

Portable, ultrasonic testing equipment provides on-the-spot inspection of metals, ceramics and similar materials. Curtiss-Wright's Mark 5F clearly locates cracks or other internal and surface defects with exceptional close-to-the-surface sensitivity. The Mark 5F is designed to provide optimum performance over a broad range of quality improvements and cost reduction applications in laboratories, shops, or in the field.

- **Portable** — 5¼" wide x 10⅝" high x 18⅛" deep
- **Lightweight** — weighs only 28 lbs.
- **Exceptional Sensitivity** — detects flaws as small as 1/64" diameter
- **High Resolution** — defects of 3/64" diameter can be detected .030" below the surface.
- **Operating Flexibility** — provides test frequencies from .6 to 5.0 megacycles.
- **Clear Presentation** — high brightness cathode ray tube provides easy viewing, even in full daylight.

Write for additional information or phone SWinburne 9-0500

CURTISS WRIGHT

Princeton Division CORPORATION **Princeton, New Jersey**

Manufacturers Representatives Solicited. Electronics and Automatic Systems engineers interested in career positions, send detailed resume to P.O. Box 110, Princeton, N.J.

cut weld cleaning time by 85%

THROW AWAY YOUR COLD CHISEL AND WHISK OFF WELD SPATTER WITH A DRY RAG! Protect-O-Metal spatter-proofing compounds make weld cleaning a breeze. Improve your welds at the same time . . . P-O-M compounds quiet the arc, improve oxidation and annealing scale, cause no porosity. No smoke, odors, or fumes.

P-O-M No. 2. Non-inflammable, non-toxic, water-soluble paste. Inorganic. Thin before applying and start welding at once. $3.40 per gallon, f.o.b. Dayton.

P-O-M No. 8. Rust- and corrosion-resistant resin base compound. Comes ready to use. Safe for all metals. Good paint primer; permits outdoor storage of sub-assemblies. $3.45 per gallon, f.o.b. Dayton.

Money-Back Trial Offer. Order a trial gallon of each today for testing in your shop. We'll cancel the bill if you're not satisfied.

Prevents Heat Treat Scale . . . up to 1500°F. Brush on, heat, brush off. All metals.

PROTECT-O-METAL

G. W. SMITH & SONS, INC. • 1701 Spaulding Rd., Dayton 3, Ohio

For More Information Circle No. 71 on Reader Service Card.

NEW! WYPO FILE FREE!

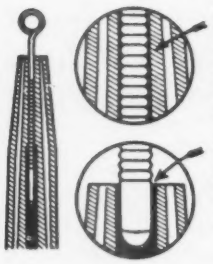
NEW POLISHED ALUMINUM CASE DESIGNED TO SERVE AS HANDLE FOR THE NEW FILE

Let Your Local Welding Supply Dealer Explain Why "YOU GET SO MUCH MORE" With . . .

WYPO
Wipes and Polishes
the World's Finest
CUTTING & WELDING TIP CLEANERS

FREE! NEW, SPECIALLY DESIGNED WYPO POLISHING FILE INCLUDED IN EACH SET

More Exclusive WYPO Features



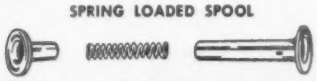
These rounded outer edges of cleaning ridges clean and polish tip orifice without scratching or cutting.

This smooth pilot guides WYPO Tip Cleaner into tip. Will not enlarge or damage tip port.

This cross section view of WYPO Cleaning Surfaces shows these exclusive features: Rounded cleaning surfaces that won't jam or cut.

Straight sided valleys insure thorough cleaning by removing all waste.

SPRING LOADED SPOOL



Spring loaded brass spool. Will not rust. Holds cleaners securely in case.

DOUBLE WOUND EYES

Insures longer life for small sizes of WYPO Tip Cleaners. Will not pull out of case.

STAINLESS STEEL POLISHING FILE

Specially designed WYPO File furnished free in each set

NOW AVAILABLE IN 3 CONVENIENT SETS

WYPO TIP CLEANERS
STANDARD SET

CLEANER NO.	FOR DRILL
7	73-74
8	72-72-71
10	70-69-68
12	67-66-65
14	64-63-62
15	61-60
16	59-58
17	57
18	56
22	55-54
24	53-52
26	51-50-49

S S WYPO FILE MADE IN U.S.A. PAT NOS 2420581, 2473750 IN CANADA 1948

STANDARD SET OF (12) Cleans (27) Drill Sizes Nos. 75 to 49 Incl.

WYPO TIP CLEANERS
JUMBO SET

CLEANER NO.	FOR DRILL
28	48-47
30	46-45
32	44-43
34	42-41
37	40-39-38
39	37-36
42	35-34-33
44	32-31
48	30

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JUMBO SET OF (9) Cleans (19) Drill Sizes Nos. 48 to 30 Incl.

MASTER SET

CLEANER NO.	FOR DRILL
7	73-74
8	72-72-71
10	70-69-68
12	67-66-65
14	64-63-62
15	61-60
16	59-58
17	57
18	56
22	55-54
24	53-52
26	51-50-49
28	48-47
30	46-45
32	44-43
34	42-41
37	40-39-38
39	37-36
42	35-34-33
44	32-31
48	30

S S WYPO FILE MADE IN U.S.A. PAT NOS 2420581, 2473750 IN CANADA 1948

WYPO TIP CLEANERS

MASTER SET OF (21) Cleans (46) Drill Sizes Nos. 75 to 30 Incl.

Replacement cleaners and files available. Cleaning Range— Cleaner No. & Drill Nos. stamped on back of each case. WYPO GIVES YOU MORE!

SOLD BY LEADING WELDING SUPPLY DEALERS

MAITLEN AND BENSON, INC.
1395 Obispo St., Long Beach 4, Calif.

Circle No. 48 on Reader Service Card.

REFERENCE DATA *catalogs, handbooks, manuals*

IMPROVED RIGIDITY and weight savings through welded steel designs is discussed in the most recent issue of Lincoln Electric Company's Studies in Applied Weldesign. Study 12043 covers machine tool tables, vacuum chucks, and loading ramps.

For More Information Circle No. 300 on Reader Service Card.

"CONTACT WHEELS and Rolls," a new folder by Carborundum Co., discusses the engineering principles of contact rolls. The folder discusses theory, selection, ordering, and use of contact wheels, and maintains that, next to the belt, the contact wheel is the most important part of an abrasive belt set up.

For More Information Circle No. 301 on Reader Service Card.

SIX COMBINATION a.c.-d.c. heavy-duty industrial metallic arc welders are described in Bulletin NH-185 available from the National Cylinder Gas Division of Chemetron Corp. Features and dimensions are given; specifications list welding current ranges, power input, and other information for each model.

For More Information Circle No. 302 on Reader Service Card.

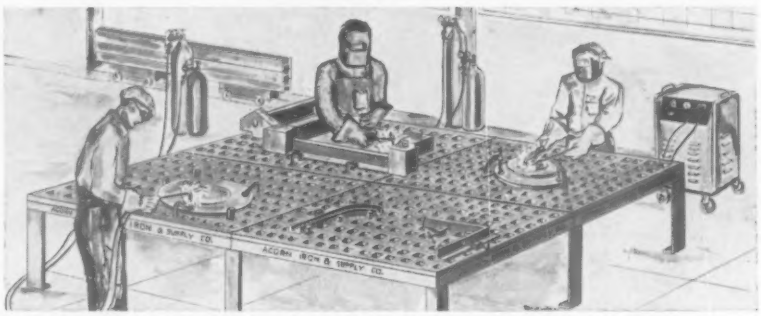
SAFETY GLOVES, clothing and equipment are listed in a new catalog published by the Advance Glove Mfg. Co. The catalog, a loose leaf binder, describes and illustrates such safety equipment as asbestos welding gloves, glovesavers, palm protectors, hand and wrist protectors, duck sleeves, forearm protectors, and first aid equipment.

For More Information Circle No. 303 on Reader Service Card.

for research, design, and development . . . metal fabrication, maintenance and plant engineering

Layout and Set-Up Blocks or Welding Platens

BENDING BLOCKS • BED PLATES • SURFACE PLATES • FLOOR PLATES



Each ACORN Bending Block or Welding Platen has 1¾" square holes, 3½" center-to-center, for clamping, dogging or spacing. Working surfaces and side edges are machined within .005" of flatness. Blocks are semisteel castings with 30,000 to 32,000 psi tensile strength. A wide variety of accessories are also available.

WRITE TODAY FOR COMPLETE LITERATURE

Used singly or in multiple groupings ACORN Welding Platens or Bending Blocks are standard equipment in many shipyards, railroads, pipe and steel fabricators, welding shops, research laboratories, and wherever metal is formed, shaped or welded.

MODELS
These models are in stock:

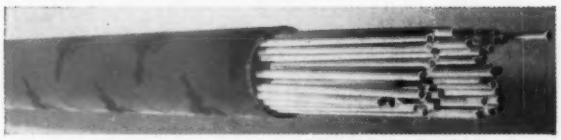
2650	2'6"	x	5'
4040	4'	x	4'
5050	5'	x	5'
5060	5'	x	6'
5080	5'	x	8'
3610	3'6"	x	10'

ACORN
IRON & SUPPLY CO.
Delaware Avenue at Poplar Street
Philadelphia 23, Pennsylvania

For More Information Circle No. 2 on Reader Service Card.

3 METHODS OF PRODUCTION BRAZING ...Which is best for you?

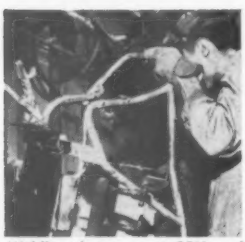
FLUX COATED ROD



A new brazing concept—engineered flux-coated bronze—thick and thin extruded coatings to fit maintenance or production needs.

Work goes fast and even with ALL-STATE's extra thin coated bronze type alloys. Flux is extruded evenly, at thickness of only .0065, to assure excellent control and easy clean-up. Narrow beads are obtained with consistent proportion of flux to rod. Coated rods are highly efficient, require minimum amounts of rod and flux.

BARE ROD AND FLUX



Welding time was cut 25% and clean-up time 75% by using All-State nickel-silver and separate flux when brazing 1" mild steel tubing in power saw frame production.

For the occasional job or where brazing operations change from time to time, ALL-STATE suggests that bare bronze with #41 or #1 flux is the most flexible method, providing maximum control of capillary flow. Recommended for deep joints.

Nickel-silver rod with #11 flux is a versatile combination for joining dissimilar metals. TS up to 80,000 psi.

The bare rod and flux method permits use of special fluxes for unusual applications.

AUTOMATIC FLUXING SYSTEM

World's largest industrial stapling machine manufacturer found solution to assembly problem with high-strength All-State #11 nickel silver and automatic Jet Flux production brazing systems.

The fastest method of surface brazing, and the most economical for production work, is automatic fluxing, available for bronze, copper and steel brazing alloys. ALL-STATE's system permits finger-tip control of liquid flux, is easy to use, requires minimum cleanup.

JET FLUX dispenser, approved by Factory Mutual, is simple to fill, operate, clean, and re-fill. Can be used to feed liquid flux in exact amounts through oxy-gas or air-gas systems. Save on fuel cost by using Liquid Jet Flux with oxy-propane or natural gas stepped up to 8 lb. pressure. Send for free information on how to adapt torch for these lower costing fuels.

ALL-STATE has quality rods and fluxes for all brazing methods. Send for folder on JET FLUX. Also free 56-page Instruction Manual and Catalog.

Distributors everywhere

All-State

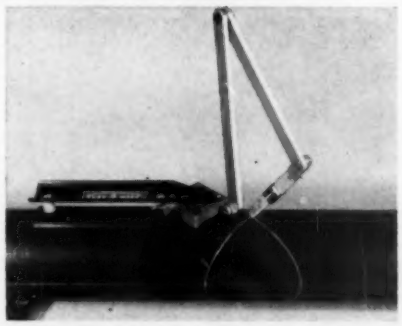
ALL-STATE WELDING ALLOYS CO., INC.
White Plains, N.Y. Dial 914 WH 8-4646
QUALITY WITH SERVICE

For More Information Circle No. 5 on Reader Service Card.

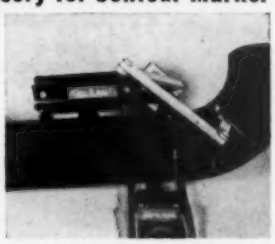
CURV-O-MARK

CONTOUR MARKER

Marks off any pipe joint or structural angle. Cut accurately, easily and without figuring cutbacks. Marks all around pipe. Saves time and gas. Available in 2 sizes of 1½" to 18" in cross-section, 16" to 48" diameter.



Combination Adaptor Accessory for Contour Marker



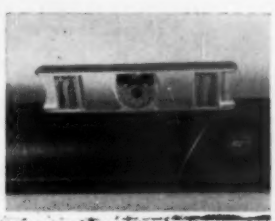
This new tool patent will prove to be a great advantage to the layman, allowing him to use all four sides of the Contour Marker in layouts on pipe or structural steel. It allows him to mark up to 30" pipe with the standard model without having to quarter or halve his pipe as he has had to do in the past. It allows him to mark over nipples, old welds, without having to break the wrap so far back on wrapped pipe.

It allows him to mark compound angles in one setting of the tool, also to mark off any portion of tube turns or 90 degrees he would so desire, as you will note in self-explanatory pictures.

The combination adaptor will also be furnished for the Jumbo Contour Marker on special order.

This tool will be sold by your welding distributor as an accessory to the Contour Marker.

Pro - Mag - Level



This level is designed for the fitter, welder, jig builder, for any layman who has angle or setting problems. The Pro-Mag-Level is 9" in length, 2" high, ¾" wide, weighing a total of 10 oz., a convenient pocket size. One side is machined to a flat plane for flat surfaces, the other side is machined to a slight V-plane for pipe work.

Body of level is made of strong aluminum casting to maintain lightness of tool. Scales are imprinted on one end for rise in degree per foot, on the other end degrees in rise per meter are imprinted.

Equipped with level and 90 degree dial marked in 2½ degrees, held in place by screw with pressure washer for easy setting.

Frame of level is equipped with two magnets on each plane for holding level in desired position, allowing the layman a third hand. Pictures of tool are self explanatory.

CONTOUR SALES CORPORATION

1843 East Compton Boulevard **Compton 2, California**

See Your Welding Supply Dealer For All Curv-O-Mark Products

For More Information Circle No. 24 on Reader Service Card.

Now You Can Weld or Cut with a HELIARC "Tig-Twin" Kit...

When you own one of the new LINDE Heliarc "Tig-Twin" Kits, you're ready to take on almost any inert-gas-shielded arc welding or cutting job!

Use the lightweight torch for Heliarc welding. It's the fast, convenient method of joining ferrous and non-ferrous metals without flux. Then use the same torch to cut light-gage metals—without additional attachments.

Heliarc "Tig-Twin" Kits contain standard, high-quality LINDE components. They're designed to perform economically through years of trouble-free service. And the price is right. Talk to your nearby LINDE distributor now. Or write for his address to Linde Company, Division of Union Carbide Corporation, 270 Park Avenue, New York 17, N. Y. In Canada: Union Carbide Canada Limited, Linde Gases Division, Toronto 12.

LINDE COMPANY

UNION CARBIDE

LINDE, HELIARC and UNION CARBIDE are registered trade-marks of Union Carbide Corporation.

For More Information Circle No. 47 on Reader Service Card.

GAMMA RADIOGRAPHY chambers are discussed in a brochure available from Philips Electronic Instruments. The brochure contains a list of Norelco Rayproofed Isotope Chambers (there are 19), with a brief description of each. Included are illustrations, descriptions, and specifications of the Norelco Gamma Radiography 192 series chambers.

Circle No. 304 on Reader Service Card.

GOT METAL HEATING PROBLEMS? Chances are, you'll find the solution in a 32-page booklet (EW-249) published by Hobart Brothers Co. The booklet discusses 400 cycle induction heating and answers why, when and what on preheating and stress-relieving questions. The 16 sections include: the purpose stress-relieving; preheating before welding; ways to stress-relieve; definitions; and references.

Circle No. 305 on Reader Service Card.

BENCH SPOT WELDER that is suitable for rough or delicate work is featured in literature from ARO Spot Welder Corp. Specifications are given for the Model M33 VP press-type precision welder.

Circle No. 306 on Reader Service Card.

FINISHING AND PROCESSING equipment and systems that were engineered, fabricated, and installed by the R. C. Mahon Company are shown in their Industrial Equipment Catalog. The catalog also includes a discussion of their planning and engineering services.

Circle No. 307 on Reader Service Card.

COLD REPAIR of cracked castings and forgings is described in a file-folder catalog available from Metalock International, Inc. The folder lists the advantages and applications of the Metalock System said to restore compressive and tensile strength to the damaged part.

Circle No. 308 on Reader Service Card.

FLASH WELDING and pressure welding facilities available at the Cleveland Pneumatic Tool Co. are described and illustrated in a colorful 12-page brochure. The brochure explains how the company's Versa-welding, a new concept in welding fabrication, results in reliability, economy, and structural integrity.

Circle No. 309 on Reader Service Card.

PRECISION EQUIPMENT for resistance welding of small parts are featured in literature from Federal Tool Engineering Co. Described and illustrated are special purpose machines, including semi-automatic contact machines and bench-mounted stored energy welders.

Circle No. 28 on Reader Service Card.

WELDING HELMETS with a new "3-C Headgear" by Fibre-Metal Products Co. are described in 4-page Bulletin No. 73. The featured headgear is all smoothly-conformable plastic with head-size and crown adjustments, clean and fully sterilizable.

Circle No. 310 on Reader Service Card.

CORROSION of various kinds, and the metals suited to resist them, are reviewed in Harpers Corrosion Guide, a 24-page illustrated brochure published by The H. M. Harper Company. Included are many charts; one lists 136 types of corrosive agents and shows how eight metals resist the corrosion.

Circle No. 311 on Reader Service Card.

THE HEART of automation is described in literature from Servospeed Division of Electro Devices, Inc. A brochure explains how modern electronic engineering gives precise motor speed control from 1/100 to 10 hp.

Circle No. 80 on Reader Service Card.

HOW MUCH WELDING TIME is productive is discussed in folder from Weld-Record Corp. Use of company's automatic weld-time recorder is described, and how its permanent record aids in time studies, reduces downtime, figures job costs, and sets job standards is explained.

Circle No. 313 on Reader Service Card.

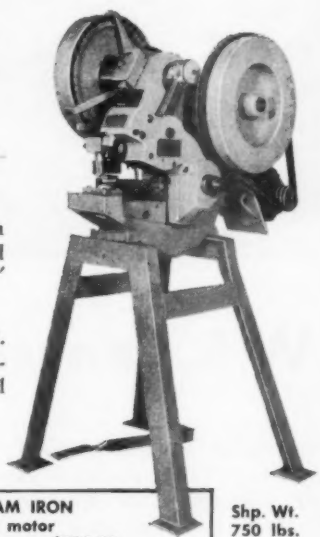
Large and Small Fabricators of steel and ornamental iron swear by it ...

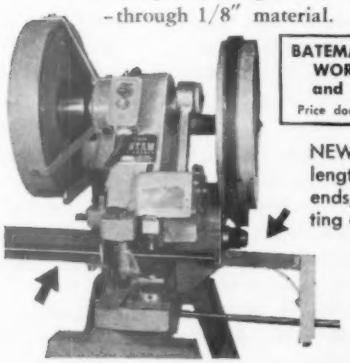
BATEMAN BANTAM IRON WORKER

The Bantam cuts and punches fast and clean . . . no grinding necessary. It's versatile, and saves time and labor! Cuts 2" x 2" x 1/4" angle and 1/4" x 4" flats.

Punches 1/2" hole through 1/4" material. Operates by hand or foot, uses 3/4 hp motor (1750) rpm., powered with flywheel and drive gear.

The Coper will cope 1-1/4" -through 1/8" material.





BATEMAN BANTAM IRON WORKER, with motor and stand $575.00
Price does not include Blades, Punches or dies.

Shp. Wt. 750 lbs.

NEW ACCESSORIES: Gauge for cutting to length, Guide for Flat Bars for cutting on ends, and Angle Iron Trimming Guide, for cutting at a 45 degree. Write for details.

WRITE TODAY for complete information and name of nearest distributor

Bateman Foundry & Machine
MINERAL WELLS, TEXAS

For More Information Circle No. 16 on Reader Service Card.

—your LINDE distributor!

In the business of welding, you'll find a capable partner in your LINDE distributor. He is ready and equipped to give you the fast, efficient, personal service you need. He maintains complete stocks of welding and cutting equipment and gases, welding rods, supplies, and accessories. And since it's his business to help your business, he concentrates on knowing what you want—and having it ready.

More than this, your LINDE distributor is an independent local businessman, familiar with nearby industry and its welding needs. When these needs include expert advice, he's prepared on that score, too. He can also call on LINDE's own technological services for the answers to new, different, or difficult welding problems. More than fifty years of pioneering in welding and cutting stand behind the LINDE brand name; through your LINDE distributor, this background is available to you.

A phone call is all it takes to get in touch with this valuable business partner. Look him up in the classified directory. Or, write for his address to Linde Company, Division of Union Carbide Corporation, 270 Park Avenue, New York 17, N. Y. *In Canada,* Union Carbide Canada Limited, Linde Gases Division, Toronto 12.

Your LINDE Distributor

"Where One Call Gets It All"

LINDE COMPANY UNION CARBIDE

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Circle No. 46 on Reader Service Card.

SYMBOLIC CHAIN is flame cut by Mlle. Blosset of the French Institute of Welding to open the AWS Welding Show. President-elect A. F. Chouinard assists her.

THIS IS PART of over $3-million worth of welding equipment, products, and accessories that were displayed at the AWS Welding Show.

Highlights of A.W.S. Convention and Show

NEW YORK CITY: The 42nd annual meeting of the American Welding Society held here in April was highlighted by the honoring of 28 individuals with 15 national and 13 regional awards.

M. D. Stepath, president of Arcair Co., won the Samuel Wylie Miller Award for his contributions toward the advancement of the art of welding and cutting.

Henri P. Granjon, director of studies at the Ecole Superieure de Soudre Autogene, Paris, was this year's Adams Lecturer. His paper was "Studies on Cracking of and Transformation in Steels During Welding."

J. Heuschkel of Westinghouse Research Laboratories was the Lincoln Gold Medalist. This award, donated by J. F. Lincoln, was presented for Mr. Heuschkel's paper on "Weld Metals in Nickel Base Alloys" as published in the *Welding Journal.*

A. F. Davis Silver Medals went to **A. L. Cooper** and **W. H. Morse,** Westinghouse Electric Corp.; **C. A. Zwissler,** Kaiser Steel Corp.; and **M. Friedmann,** Friedmann Welding Co., for contributing to the progress of welding in structural design, maintenance and hard surfacing, and design.

Dr. N. N. Rykalin, professor of metallurgy, U.S.S.R. Academy of Sciences, received the Educational Lecturer Certificate Award for his educational lectures.

The National Meritorious Service Awards went to **G. E. Claussen,** Arcrods Company, and **H. E. Miller,** Carrier Corp.

W. H. Munse, University of Illinois; **W. E. Savage,** Rensselaer Polytechnic Institute; and **R. C.**

W. D. KIDD (left), winner in the Murex contest, receives the keys to his new car from N. F. Kiernan, sales manager of Metal & Thermit's Welding Products Division. Mr. Kidd came up with the closest estimate of the number of M&T Murex electrode displayed in a glass container.

THREE 180 AMP ARC WELDERS were awarded by Mid-States Welder Mfg. Co. Tom Dempsey (center), publishing director of WD&F, hands winning names to O. E. Fenske, Jr., Mid-States vice president-sales (left). William Jetter, president of Mid-States, looks on.

Wiley, California Polytechnic Institute, received the Adams Memorial Membership Award for outstanding teaching activities.

Honorary membership in the Society was conferred on **H. E. Rockfeller,** Linde Company, Division of Union Carbide Corp.

ELECTION OF OFFICERS

A. F. Chouinard, director of research and development for National Cylinder Gas Division of Chemetron Corp., was elected president of the AWS and was officially presented to members at the opening ceremonies. Mr. Chouinard has been active in Society affairs for many years. He was elected vice president of AWS in 1959 and is a past chairman of the Chicago AWS section.

Jay Bland, manager of welding development, General Electric Knolls Atomic Power Laboratory, Schenectady, was elected vice president. He joins Clarence E. Jackson, Linde Company, and John Blankenbuehler, Hobart Brothers Co., as one of three AWS vice presidents.

CHOUINARD

BLAND

New directors installed include **T. E. Jones,** Precision Welder and Machine Corp.; **J. E. Dato,** Linde Company; **E. C. Miller,** Oak Ridge National Laboratory; and **A. N. Kugler,** Air Reduction Sales Co.

New district directors named include **C. L. Kreidler,** Lehigh Structural Steel Co.; **W. J. Erichsen,** Westinghouse Electric Corp.; and **P. J. Rieppel,** Battelle Memorial Institute.

WELDING SHOW HIGHLIGHTS

Over $3-million worth of welding equipment, products, and accessories were displayed during the 3-day Show. The display is claimed to be the largest assembly of welding equipment and materials ever gathered under one roof.

Prizes were given away by many of the exhibitors.

Metal & Thermit Corporation gave away a 1961 Ford to the person who came closest to guessing the number of welding electrodes in a glass container. Winner was **William D. Kidd,** Schacht Steel Construction, Inc., Hillside, N. J. Mr. Kidd came closest to the correct answer: 8549 electrodes.

Mid-States Welder Mfg. Co. gave away three 180 amp arc welders. Winners were **W. D. Linch,** E. I. duPont deNemours; **A. S. Carlson,** Spencer Turbine Co.; and **Alphonse Popkowski,** Acme Welding Co.

INTERNATIONAL WELDING

The AWS Convention and Show immediately followed the week-long meeting of the International Institute of Welding. **AWS President R. D. Thomas** stressed the importance of American participation in it. He pointed out that we in the United States have been reluctant to join in the establishment of international codes and standards, preferring to remain aloof and independent. "American isolation," he said, "both political and technical, is at an end."

Send for this **NEW HELPFUL** Brazing **BULLETIN**

AMERICA'S FINEST and newest manufacturer of brazing alloys offers you this bulletin to help solve your brazing problems . . . and invites you to request sample alloys on your letterhead. We will send you our equal to these alloys:

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Tel: MOunt Vernon 4-5858
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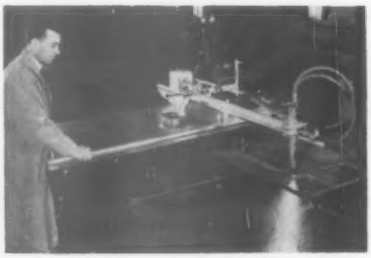
NEW PRODUCTS



Economical Flamecutter

A new, low cost, metal cutting machine has been introduced by National Cylinder Gas Division of Chemetron Corp. for small shops. The new Type RM1 portable machine does not take skill. Unit does automatic production work from steel templates, straight-line cutting (square or bevel), hand-guided cutting, and compass-guided circular cutting with 2⅜ to 15¾-inch radii.

Circle No. 202 on Reader Service Card.

Coated Brazing Rod

A brazing rod with an extruded flux coating has been announced by Ampco Metal, Inc. A demand for high production brazing resulted the development of Ampco-Braz #2 FC. The extruded coating cleans and tins effectively.

Circle No. 203 on Reader Service Card.

New X-Ray Unit

A new industrial x-ray unit has been introduced by Sperry Products Company, a division of Howe Sound Co. Designed for plant or lab, the x-ray is available in 275 and 300 KVP models. The unit costs less but has the same characteristics and performance as the company's portable equipment.

Circle No. 204 on Reader Service Card.

NEW ARMSTRONG CATALOG
Quality Tools for Industry

New ARMSTRONG General Catalog No. 700, showing the complete ARMSTRONG Line including approximately 330 new ARMSTRONG tools added in these categories:

- Tool Holders
- Set-Up-and-Hold-Down Tools
- Tool Bits
- Wrenches
- Ratchet Wrenches and Sockets
- Miscellaneous Hand Tools
- Pipe Tools

Anyone who uses or buys hand tools or shop tools needs this free ARMSTRONG Catalog No. 700 showing these important additions as well as thousands of other ARMSTRONG tools. Write direct, or phone your local ARMSTRONG Distributor (Distributor name furnished upon request).

Armstrong Bros. Tool Co.
5262 W. Armstrong Ave. • Chicago 46, Illinois
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KELLER *POWER* HACK SAWS
NEW . . . PORTABLE
JEFFERSON "601", 5" x 4" Capacity

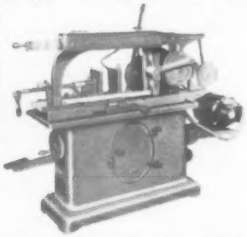
Now available with cast legs, 7" ball bearing, rubber tired wheels & convenient handle. Complete with motor, switch, wired, ready-to-go.

$114.50
F.O.B. Factory

MODEL 3CH, 6¾" x 6¾", Wet Cut.

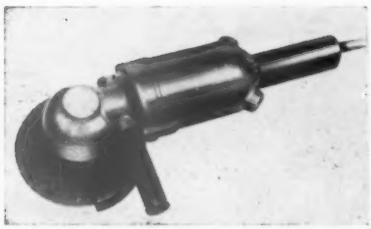
Controlled pressure, relieved back stroke for fast cutting at LOW COST. Complete with motor, switch, wired, ready-to-go.

$498.00
F.O.B. Factory



5 Sizes - 12 Models. Ask your Welding Equipment Distributor or write for descriptive Bulletin 361.

Sales Service Mfg. Co.
2365 University Ave., St. Paul 14P, Minn.
Circle No. 67 on Reader Service Card.



Right Angle Grinder

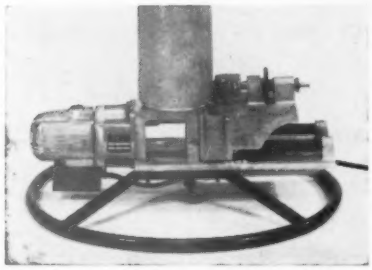
A West German-made right-angle grinder offering a new concept in weld-grinding and cut-off operations is marketed here in the U.S. by Brunmar Commercial Corp. Equipped with a 2 hp heavy-duty motor designed for 8,000 rpm on the 7-inch models and 6,600 rpm on the 9-inch models, the grinder operates on 110 volt, single phase a.c., or optional 220 volt. Grinders are approved by Underwriters Laboratories, Inc. and the Canadian Standards Association.

Circle No. 205 on Reader Service Card.

Silver-Brazing Flux

A quality, micro-ground, production silver-brazing flux for torch, furnace, or induction brazing on stainless, nickel, copper, brass, bronze, steel, beryllium-copper, and all silver alloys has been announced by All-State Welding Alloys Company, Inc. Called S-200 Brazaloy, flux is active between 600 and 1,800 F. A wetting agent assures an even brazing film during the heating cycle. Flux comes off in hot water.

Circle No. 206 on Reader Service Card.



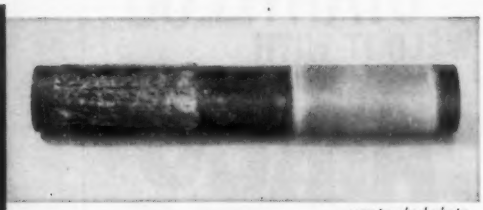
Pipe-End Preparation

A portable machine for accurate bevels on pipe in the field has been announced by Hogden, Lovett & Powell. Called Port-O-Kut, the new machine weighs fifty pounds and operates on 115 volts a.c. or d.c., or optional air motor. It will bevel a four-inch alloy or carbon steel pipe in two minutes, or a four-inch aluminum pipe in ten seconds.

Circle No. 207 on Reader Service Card.

How flame spraying can pay for itself in your shop in a very short time

ONE EXAMPLE
Hard facing time cut from 4 hours to 25 minutes



unretouched photo

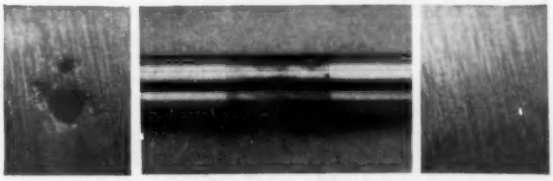
The two end sections of this shaft have been built up with AMS 4775. Section at left applied by welding – time 4 hours; section at right by flame spraying – time 24 minutes, 45 seconds.

QUESTION: Look at the picture. Which end would you prefer to grind finish?

Here's the whole story. We took a 15″ length of 2.5″ mild steel shafting and undercut two 5″ sections .050″ on the radius. We then sent the shaft to a nationally-known job shop with instructions to apply AMS 4775 on the left-hand section, sufficient to finish at 2.5″. Weight of welded-on alloy was 17 9/16 ounces – time spent by one of their top men – 4 hours (including preparation).

Then we blasted the second section with steel grit and flame sprayed it with AMS 4775 in powder form (ThermoSpray Powder 15E). The coating was then torch-fused. Weight of deposited alloy – 11 5/16 ounces; surface preparation, set-up and pre-heat – 12 minutes; spray time – 5.5 minutes; fusing time – 7.25 minutes.

Unretouched photo, in center, shows finish-ground shaft. Insets, magnified about 50X, show pits in welded section (left) and no pits in flame sprayed section at right.



We then sent the shaft out to a grinding shop with instructions to clean up at 2.500″ plus. The flame-sprayed section cleaned up at 2.510″ but welded section still showed pits when grinding was stopped at 2.477″ Rockwell of welded end Rc-61, sprayed end Rc-60.

Pump plunger being flame sprayed with METCO ThermoSpray® Powder Gun

These flame-sprayed coatings are solid, homogeneous; usually superior to those applied by other methods. You can apply them at high speed, with lower material and finishing costs. In addition to AMS 4775, a number of other powders – including tungsten carbides – are available for various service requirements; all may be fused–some used as sprayed for certain service requirements.

For further information on this high-speed, money-saving, hard-facing process, phone, write or wire.

METCO INC.
FORMERLY METALLIZING ENGINEERING CO., INC.
Flame Spray Equipment and Supplies

1179 Prospect Ave., Westbury, L. I., N.Y. Telephone: Edgewood 4-1300 Cable: METCO
In Great Britain: METCO., Ltd., Chobham-near-Woking, England

FREE BULLETIN

FREE BULLETIN: Send off the coupon for this and other useful information which shows how flame spraying pays for itself–in a very short time. No obligation, of course.

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Please send me information on hard-facing by flame spraying.

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Company _____

Address _____

City _____ Zone _____ State _____

For More Information Circle No. 58 on Reader Service Card.

Circle No. 3 on Reader Service Card.

TO FABRICATE STAINLESS WELD IT WITH AIRCO-MATIC

AIRCOMATIC® welding is the lower cost way to fabricate. Weldments show excellent ductility, tensile, and impact properties. Tailored to the process, Airco's wide range of Aircomatic stainless wires can be used for welding all standard alloy types. Remember: Only Airco makes everything you need for stainless welding.

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- ☐ 1. Cast Iron Welding Flux
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- ☐ 4. "Braz-Cast" Flux for Bronze Welding Cast Iron
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Order "Anti-Borax" Fluxes By Number

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Circle No. 12 on Reader Service Card.

Field Welding of Line Pipe

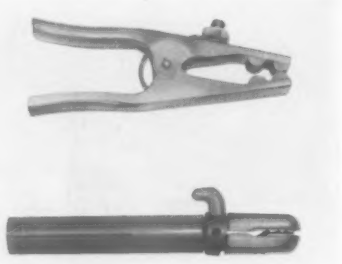
Over three years and a half million dollars were spent in the development of the Aircomatic Pipe Line Welder. Air Reduction's Special Products Department designed and built the welder with the help of Esso Research & Engineering Co. and Battelle Memorial Institute. Humble Oil Company field tested the machine on pipeline construction.

Clamps align and hold pipe to be joined while the welding head automatically rotates around the joint. Before welding, an abrasive wheel cleans the butting ends, then Air Reduction's Aircomatic high-speed CO_2 shielded metal arc process makes the weld. This machine is said to do the job 20 times faster than manual welding.

It can be positioned over the pipe-joint by a side-lift tractor.

Although present units weld four-, six-, or eight-inch diameter pipe, the company expect to build machines that will weld pipe as large as 36 inches in diameter.

Circle No. 208 on Reader Service Card.



Holder and Clamp

A new tong type electrode holder and wide jaw ground clamp have been introduced by Lenco, Inc. The holder applies pressure mechanically instead of with a conventional spring. The clamp also features positive grounding on pipe and other round surfaces.

Circle No. 209 on Reader Service Card.

Manganese Electrode

A new concept in nickel-manganese steel electrodes has been developed by Rexarc, Inc. Called Rexarc Manganese Build-Bond, the mineral coated electrode builds up or bonds austenitic manganese steel. Deposition is rapid; the metal strong, ductile, wear-resistant, and of 75 to 85 Rockwell B hardness.

Circle No. 210 on Reader Service Card.

King Size Acetylene Cylinder

A new, large-capacity cylinder that holds 1000 cubic feet of acetylene has been announced by Coyne Cylinder Company. Called Coyne 1000, the 38-inch-high and 20-inch-wide cylinder's large capacity results in a reduction in handling, trucking, maintenance, and parts replacement.

Circle No. 211 on Reader Service Card.

Safety-Fused Plug

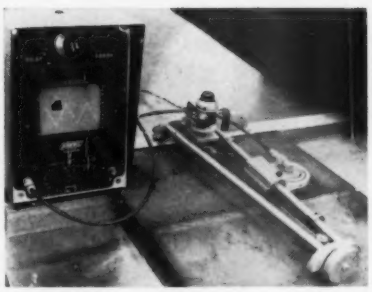
A plug-in distribution system for electrical resistance preheat and stress relief with safety-fused plugs to protect equipment and personnel, has been introduced by J. B. Notting'ıam & Co., Inc. The 2- and 3-pronged plugs have fuses at their base to prevent overload when heaters are added. Proper mating of a plug with its block makes a low-resistance, sealed connection.

Circle No. 212 on Reader Service Card.

Flash Welding Machine

A high capacity welding machine designed and built by Thomson Electric Welder Company flash welds aluminum to copper bar stock. The work is preheated, flashed, and upset automatically. The resulting welds, produced in seconds, can withstand 180-degree bend tests. Rated as a 400 KVA machine at 50 percent duty cycle, the F-5 model machine is contained in a heavy fabricated steel frame, 82 inches high, 130 inches wide, and 70 inches deep.

Circle No. 213 on Reader Service Card.



Ultrasonic Inspection

A new idea in weld inspection, B-scanning ultrasonic test equipment, has been introduced by Branson Industries, Inc. Called Sonoray 5, unit is said to be faster and safer than x-ray, have lower original and operating costs, and often give more reliable results. Basically, the Sonoray flaw detector sends bursts of sound into the welded plate, and picks up any returning echo. If the sound wave meets any obstacles, some of the energy reflects and interrupts the pattern on the cathode ray tube at the exact flaw location.

Circle No. 214 on Reader Service Card.

Experimental Alloys

The Colmonoy Division of Wall Colmonoy Corp. has announced two experimental hard-surfacing alloys. Wallex No. 50 is a cobalt-base powder of the cobalt-chrome-tungsten type which is designed for Sprayweld process application. Colmonoy No. 8, a nickel-chrome-boron alloy, provides better resistance to oxidation and corrosion, and improves resistance to high stress-abrasion.

Circle No. 215 on Reader Service Card.

Flux-Coated Brazing Alloy

Eutectic Welding Alloys Corp. has announced a new flux-coated silver brazing alloy. Designated 1020FC, the new alloy makes application of silver alloy convenient, fast, and without the mess and waste associated with a separate flux. Alloy 1020FC applies easily in difficult positions and poor fits.

Circle No. 216 on Reader Service Card.

REMOVE SMOKE, DUST, FUMES with

ARCAIR FLEX AIR MOVER

Arcair jet pump type air mover — the quick, low cost way to exhaust foul air fumes and dust from closed and poorly ventilated work areas. It has simple maintenance-free design, high velocity performance, low noise level. Write today for complete details . . . or see your welding supply distributor.

THE Arcair COMPANY

Bremerton, Washington
429 S. Mt. Pleasant St., Lancaster, Ohio

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WELDERS -- YOUR EYES DESERVE THE BEST!

ONLY THERMO GROUND and POLISHED FILTER PLATES CAN GIVE YOU 100% UNIMPAIRED VISION

There is no substitute for a Thermo Optically Ground and Polished Filter Plate which is carefully graded and selected to insure you a sharp definition and eliminate fatigue.

The restful soft green shade gives you maximum reduction of eye strain.

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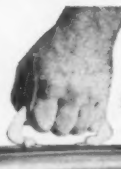
For More Information Circle No. 74 on Reader Service Card.

flaw hunter

with this  in hand

you find cracks and hidden surface flaws

in ✓ **metals**
in ✓ **plastics**
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in ✓ **glass**
in ✓ *minutes*

USE PIXchek penetrant dye system for inspection after any metal-working process—casting, forging, welding, grinding, extruding, drawing, shearing—the gamut of operations. PIXchek is equally adaptable to single part or quantity-run inspection.

Everything you need is in this handy flaw-hunting kit

Sturdy steel hinged case with aerosol spray cans of PIXchek Dye, Cleaner, and Developer, plus extra cans of Dye and Cleaner for brush and wipe-on applications. The coupon below can start you flaw hunting right away.

$ only **35**

Picker x-ray

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Please ship ☐ PIXchek Kits @ $35.00

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City_____ Zone_____ State_____

Purchase Order No._____

Circle No. 63 on Reader Service Card.

Automatic Pipe Welding in the Field

The automatic welding of large diameter, transmission-line pipe without rotating it is now possible with an automatic welding machine developed by H. C. Price Co. in cooperation with Crose-Perrault Equipment Corp. and Hobart Brothers Co. Field tested on pipeline projects, the machine will automatically weld 36-inch A.P.I. 5LX Grade X52 of $\frac{7}{8}$-inch wall thickness in under 8 minutes. The welds meet A.P.I. code requirements.

The machine uses a Hobart Micro-Wire welding process: a gas shielded arc welding process using CO_2 gas, small diameter electrode wire (usually 0.035 to 0.045 inches), low voltage (19 to 29 volts), and a relatively low welding current (120 to 150 amps, d.c. reverse polarity).

No preparation is required for welding; backup rings are unnecessary; and the welds require no cleaning or grinding. Pipe ends are aligned with a standard gap between them and held with a single hydraulic clamp.

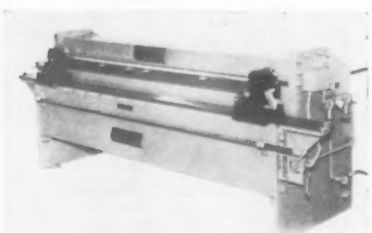
The operator has complete control of the operation with a pendant control held in his lap. Two men can quickly position the machine.

Circle No. 217 on Reader Service Card.

Cutting Machine

A unique flame cutting machine called Bug-O-Multipurpose, has been developed by Weld Tooling Corp. The machine's cutting torch, attached to its own aluminum rigid rail, can cut at any angle, in any position including overhead. Permanent magnets hold the rail against the work. The machine is geared to the rail and moves at accurately controlled variable speeds. An accessory, called a Panograph, maintains uniform torch spacing for accurate beveling. Torch supports permit the use of several torches at once.

Circle No. 218 on Reader Service Card.



Roll Shear Flanging

A newly developed roll shear flanging machine has been announced by Airline Welding & Engineering. The machine, designed for accurate shearing and flanging of thin metals, makes it easy to get full-strength butt fusion welds on foil-thin metals.

Circle No. 219 on Reader Service Card.

Circle No. 31 on Reader Service Card.

IN 1936, MORT CLARK, then Vice-President of the world's largest sign manufacturer, wanted a welded galvanized sign frame. Every welder manufacturer said it couldn't be done . . . Mort Clark did it, received a check and certificate of achievement from the Lincoln Welding Foundation—and

MORT CLARK'S **GALV-WELD** ALLOY ORIGINAL & GENUINE

WAS BORN

The Navy didn't believe, tested it 3384 hours in salt spray (100 hours is normal), then approved it. Westinghouse reports Galv-Weld roof sign, installed 1936—still perfect in 1959—23 YEARS LATER!

TIME PROVEN — MODESTLY PRICED
WHY EXPERIMENT?

Regalvanizes corrosive seams and areas where galvanizing is burned away by welding, skipped in hot dip galvanizing, or abraded in fabrication.

Eliminates corrosion areas produced by welding, so that weld will stand up under paint, WITHOUT rust, as on ornamental iron. Simply use residual heat from welding, or reheat, wire brush, and apply. No fluxing—No fumes.

Makes every welder a galvanizer of small weldments or parts. Repairs chipped porcelain, rusted appliances, rusted auto, truck or trailer bodies, frames, fenders, or other steel products. Can be readily refinished to match surrounding surface.

Ideal for pipe joints, galvanized structures, water and fuel tanks, duct systems, cold storage lockers, sinks, drains, washers, towers, steel buildings, railings, etc.

Some distributor franchises still available. Cash in on consistent campaign now running in 18 national magazines.

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Send Information User ☐ Distributor ☐
Dealer ☐ Free Sample ☐

Name .....

Address .....

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Keen-Cut Electrodes
for use in

CARBON ARC-AIR JET GOUGING

KEEN-CUTS—for the best characteristics of carbon and graphite in a carbon arc cutting electrode. Higher current capacity . . . longer life . . . shorter cutting time . . . greater material removal . . . smooth surface gouge . . . controllable accuracy . . . hot stable cutting arc . . . elimination of smoke and gases.

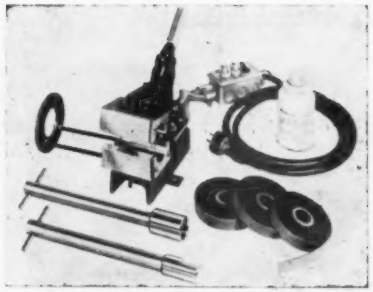
And they're low in cost. Try BECKER KEEN-CUT ELECTRODES—black or copper coated, standard diameters, 12" lengths in 150 to 1400 amp. range—for the most efficient, labor-saving electrode in carbon arc/compressed air cutting.

A COMPLETE LINE OF CARBON AND GRAPHITE WELDING SUPPLIES—carbon and graphite electrodes, carbon rods and plates, welding paste, graphite cores and chills, graphite powder and particles of any mesh.

Write for Catalog

BECKER BROTHERS CARBON CO.
3442 South Laramie Ave.
CICERO 50, ILLINOIS

Circle No. 18 on Reader Service Card.



Cable Vulcanizing Kit

A vulcanizing kit for making quick, waterproof connections or repairs on neoprene insulated cable, has been developed by Cam-Lok Division, Empire Products, Inc. The kit includes a thermostatically controlled 110 volt vulcanizing press, uncured neoprene vulcanizing tape, and all tools necessary for an unskilled person to make perfect connections.

Circle No. 220 on Reader Service Card.

225 Amp Welder

Lincoln Electric Co. has introduced a 225 amp AC transformer welder that fills the need for welder performance between high capacity production welding equipment and small 180 amp shop welders.

Dial-type current control is available over an amperage range from 40 to 225 amperes. Electrodes to 3/16-inch can be used to weld any thickness. Unusually stable arc characteristics permit use of all electrode types. Compact, lightweight welder operates on 220 volt, single phase power.

Welding cables, headshield, holder and ground clamp are included. Wheels are optional.

Circle No. 45 on Reader Service Card.

Temperature Indicators

The Tempil Corp. has produced 5 new Tempilstiks for indicating heats between 2000 and 2500°F. Intervals are 50°F instead of the former 100°F. Tempil now offers 86 Tempilstiks in regular steps between 100 and 2500°F.

Circle No. 221 on Reader Service Card.

***Tempilstik*°**
temperature indicating crayons *

**Also Tempil° Pellets and Tempilaq° (liquid form)*

***Tempilstik*°—a simple and accurate means of determining preheating and stress relieving temperatures in welding operations. Widely used in all heat treating—as well as in hundreds of other heat-dependent processes in industry. Available in 80 different temperature ratings from 113°F to 2500°F . . . $2.00 each.**

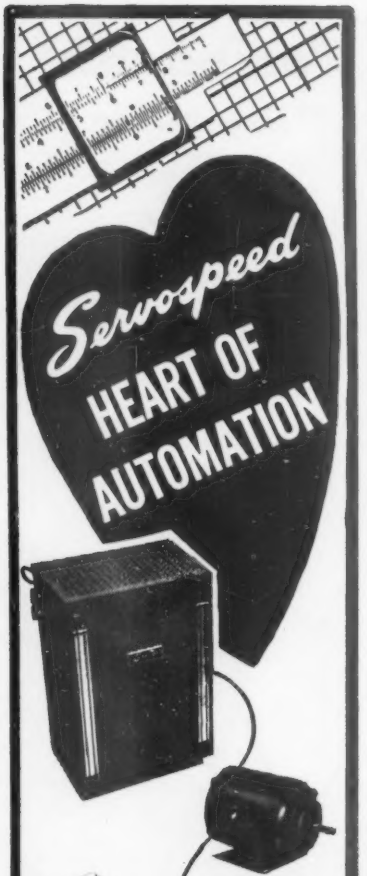
Send for *free* sample Tempil° Pellets. State temperature desired . . . Sorry, no sample Tempilstiks°

Most industrial and welding supply houses carry Tempilstiks° . . . if yours does not, write for information to:

SALES DEPARTMENT

***Tempil*° CORPORATION**
132 West 22nd St., New York 11, N. Y.

Circle No. 73 on Reader Service Card.



MODERN ELECTRONIC ENGINEERING GIVES PRECISE MOTOR SPEED CONTROL

1/100 — 10 H. P.

Modern industrial electronic engineering has been coordinated with electric motor design to provide a versatile means for obtaining the full possible advantage of speed control in DC motors while operated from the regular alternating current power line. Grid controlled "Thyratron" tubes are utilized for power controlled stepless variation to supply motor armature power. Patented feedback, or "Servo" circuits provide constant torque capability over wide speed ranges of as high as 60 to 1 in some models and a minimum of 20 to 1 in others

Servospeed
DIV. of ELECTRO DEVICES, Inc.
4 Godwin Ave., Paterson, N. J.
ARmory 4-8989

Circle No. 80 on Reader Service Card.

JACK SMITH

McBURNEY

Smith Welding Changes Name, Corporate Set-up

MINNEAPOLIS: A new corporate name, the opening of a new division, and a change in officers has been announced by the board of directors of Smith Welding Equipment Corporation.

Smith Welding Equipment will become a division of Tescom Corporation, as will a new Fluid Systems Division, informally activated January 1st. The word Tescom is coined from The Elmer Smith Company of Minnesota, in honor of the founder, Elmer H. Smith, chairman of the board for the past 12 years. Smith now becomes honorary chairman of the board. New board chairman will be L. L. McBurney, who steps up from the presidency of Smith's. Moving into the top management spot as the new president of Tescom Corporation will be Jack E. Smith, formerly executive vice-president. G. C. Swenson will be secretary.

P. E. Taylor, vice-president in charge of sales for Tescom, said the moves strengthen Smith Welding Equipment's total marketing function. At least three new products will be introduced this year, and the change will give greater emphasis to welding equipment by allowing complete attention within the divisional structure. Taylor states the pattern of Smith's sales distribution will be unchanged. All products are sold exclusively through distributors.

Manufacturing operations and headquarters will remain in Minneapolis. Ownership of the company is unchanged.

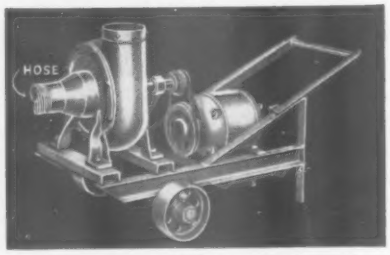
ANYBODY'S PRIVILEGE

You may request more data on any item in this magazine that has a Reader Service Number by circling that number on the Reader Service Card, regardless of whether or not you are the subscriber to whom the magazine was addressed.

Circle No. 66 on Reader Service Card.

RUEMELIN *Portable*
Fume Collector

Removes gas, smoke and heat from welding operations. Recommended for ventilation of tank interiors, manholes, vats, airplane fuselages or for blowing fresh air into inaccessible places.



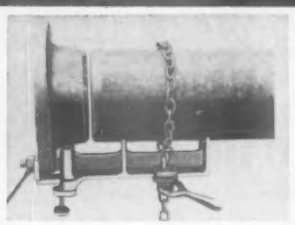
● Collector is equipped with a power unit capable of handling up to 35 ft. of steel tubing. Mounted on rubber tired wheels for ease of handling. Models also available mounted on steel legs for hose operation in a complete 360 degree circle.

● This view shows inlet hood picking up welding smoke. Operator breathing zone protected.

WRITE FOR DETAILED INFORMATION.

RUEMELIN MFG. CO.
3932 N. Palmer St., Milwaukee 12, Wis. U.S.A.
Manufacturers and Engineers • Sand Blast and Dust Collecting Equipment • Welding Fume Collectors

SEE JEWEL FOR . . .



The JEWEL Flange Clamp
lines up the flange face at right angles to pipe end and holds until tacked. Takes size from 2½" to 16".

The JEWEL Pipe Clamp
. . . aligns and holds pipe for tacking. Two sizes: ½" to 8" and 8" to 16". Sturdy construction for hard usage.

The JEWEL Elbow Clamp
lines up welding elbows from 2½" to 8" at right angles to the pipe and holds them until tacked.

The JEWEL Angle Clamp
holds branch line at right angles to the main or headers. Takes any size main or branch from ½" to 12".

The JEWEL Pipe Marker
marks a perfect hole and saddle on any pipe up to 20".

Write For Details

Jewel Manufacturing Co.
1841 University Ave., St. Paul 4, Minn.

Circle No. 39 on Reader Service Card.

Data Offered in This Month's Ads

Readers may obtain any of these free reference materials by circling the corresponding numbers on the Reader Service Cards

1: Portable spot welder is illustrated in literature. **ARO Spot Welder Corp.**

2: Welding platens are described in literature. **Acorn Iron & Supply Co., Inc.**

3: Stainless welding wires are featured. **Air Reduction Sales Co.**

4: Spot welding tips and holders are described in a catalog. **Air Reduction Sales Co., Tuffaloy Dept.**

5: Jet flux folder offered. **All-State Welding Alloys Co., Inc.**

6: Alloy electrodes for every arc welding job are described in literature. **Alloy Rods Company**

7: Brazing alloys are listed in a catalog. **American Brazing Alloys Corp.**

8: Resistance welding tips are featured. **American Metal Climax, Inc.**

9: Gloves for any job are illustrated in a catalog. **American Optical Company**

10: Low temperature silver brazing with special fluxes is subject of booklet. **American Platinum & Silver Div., Engelhard Industries**

11: Resistance welding products are featured. **Ampco Metal, Inc.**

12: Fluxes for welding and brazing are listed. **Anti-Borax Compound Co., Inc.**

13: Removal of dust, smoke and fumes is featured in literature. **The Arcair Company**

14: Tools for industry are listed in a catalog. **Armstrong Bros. Tool Co.**

15: Weld cleaning tools are featured. **Atlas Welding Accessories Inc.**

16: Iron workers and accessories are listed in data. **Bateman Foundry & Machine**

17: Reinforced resinoid disc-wheels are described in literature. **Bay State Abrasive Products Co.**

18: Carbon arc gouging is featured in material. **Becker Brothers Carbon Co.**

19: Ultrasonic weld inspection is featured. **Branson Industries Inc.**

20: Face and eye protection equipment are listed in a catalog. **Chicago Eye Shield Co.**

21: Chipping hammers are described in a bulletin. **Chicago Mfg. & Distributing Co.**

22: Blowtorches are featured in literature. **Clements Mfg. Co.**

23: Shears are described in catalog. **Cleveland Crane & Engineering Co.**

24: Pipe layout equipment is featured. **Contour Sales Corp.**

25: Ultrasonic flaw detection is featured. **Curtiss Wright Corp., Princeton Div.**

26: Welding tips and spot welding equipment are shown. **Eisler Engineering Co., Inc.**

27: Arc welding accessories and welding circuits are explained. **Erico Products Inc.**

28: Precision resistance welding equipment are featured. **Federal Tool Engineering Co.**

29: Welding helmets and accessories are featured. **Fibre-Metal Products Co.**

31: Galvanizing small parts and weldments is described in data. **Galv-Weld Products**

32: Preformed alloys for silver brazing are listed in a data book. **Goldsmith Bros., Division of National Lead Co.**

33: Axles, jacks, and couplers are featured in a catalog. **Hammer Blow Tool Co.**

34: Silver brazing details are contained in a booklet. **Handy & Harman**

35: Gas welding and cutting outfit is featured. **Harris Calorific Co.**

36: Resistance welding alloys and tips are featured. **Hercules Welding Products**

37: Welders of all types and sizes are listed in a catalog. **Hobart Brothers Co.**

38: Electrode holders are listed in a catalog. **Jackson Products**

39: Clamps for various uses are described. **Jewel Manufacturing Co.**

40: Metal cutting band saw is described in literature. **Johnson Manufacturing Corp.**

42: Electrode holders and ground clamps are featured. **Lenco, Inc.**

43: King-size facilities are described in literature. **Lewis Welding & Engineering Co.**

45: Arc welder for light manufacturing is described in bulletin. **Lincoln Electric Co.**

46: Welding distributors and how they serve local needs are described. **Linde Co.**

47: Tig welding with a Heliarc 'Tig-Twin' Kit is described. **Linde Co.**

48: Tip cleaners are featured in literature. **Maitlen and Benson, Inc.**

49: Weld inspection is the subject of literature. **Magnaflux Corp.**

50: Magnetic ground clamp is described in data. **Magna Cast Tool Co., Inc.**

51: Dye penetrant materials in spray cans are described. **Magnaflux Corp.**

52: News and tips on resistance welding are offered. **P. R. Mallory & Co., Inc.**

53: Material handling devices are described in a catalog. **Merrill Brothers**

54, 55, 56, 57: Electrode selector lists over 1,000 types and sizes. **Metal & Thermit**

58: Flame spraying hard facing is described in a bulletin. **Metco, Inc.**

59: Welder/power plant specifications are featured. **Miller Electric Mfg. Co., Inc.**

60: Nibblers that cut all metals are featured. **Modern Mfg. Co.**

continued on page 86

Circle No. 50 on Reader Service Card

On and Off in seconds . . . No awkward clamps, screws or springs needed to hold ground to work.

Rugged aluminum body makes for improved electrical contact; ground remains cooler, thus increasing efficiency of welder.

A great time-saver . . powerful, long-lasting built-in Alnico magnets produce a vise-like grip that holds the ground hog to work in any position . . . on flat, round or angular surfaces.

LIST EACH

$7.95

MAGNE ● Distributor territories still open.
CAST TOOL CO., Inc.
4614 WEST 5TH AVE. • CHICAGO 44, ILL.

INSIST ON

HI-AMP®

MANUAL ARC WELDING

ELECTRODE HOLDERS

GROUND ATTACHMENTS

Buy from your local

WELDING SUPPLY HOUSE

LENCO, INC.

350 W. ADAMS ST., JACKSON, MO.

Circle No. 42 on Reader Service Card.

DATA FEATURED IN ADS

continued from page 85

61: Shape cutting machines are featured in literature. **Ohmstede Machine Works, Inc.**

62: Radiographic group inspection is discussed. **Picker X-ray**

63: Flaw hunting kit is featured. **Picker X-Ray**

64: Compressed gas cylinders are listed in a catalog. **Pressed Steel Tank Co.**

65: Positioners for all welding jobs are described. **Progressive Welder & Machine Co.**

66: Portable fume collectors are described in a brochure. **Ruemelin Mfg. Co.**

67: Power hacksaws are featured. **Sales Service Manufacturing Co.**

68: Oxy-acetylene and oxy-LP gas flame traits are shown on a chart. **Smith Welding Equipment Corp.**

69: All position electrode is featured in literature. **A. O. Smith Corp.**

70: Welder control planning is described in bulletin SM-277. **Square D Company**

71: Weld cleaning is discussed. **G. W. Smith & Sons, Inc.**

72: Hardfacing and piercing electrodes are listed in catalog. **Stulz-Sickles Co.**

73: Temperature indicating crayons are featured in literature. **Tempil Corp.**

74: Lens covers of plastic are featured. **Thermacote Co.**

75: Gloves and garments for welding are described. **John Tillman & Co.**

76: Electrodes for resistance welding are listed in a catalog. **Tipaloy, Inc.**

77: Welding and cutting unit is featured. **Victor Equipment Company**

78: Automatic and semi-automatic inert gas welding package is featured. **National Cylinder Gas Division, Chemetron Corp.**

79: Welding variables: Complex joints, fussy metals, and tricky fixtures are discussed. **Linde Co.**

80: Motor speed control is featured. **Servospeed Div., Electro Devices, Inc.**

CLASSIFIED

Cost of all ads in this section is $20 for the first inch and $15 for each additional inch or fraction thereof. Rates for display ads in this section will be sent on request. All classified advertising payable in advance.

SALES ENGINEER

For Midwest manufacturer of production fusion welding machines. Must have experience in mass production techniques and automatic welding process applications. Ability to visualize methods of process mechanization, and to prepare quotations, specifications, and negotiations with customer through sales representatives is required. Age 30-35. Only applicants possessing these qualifications will be considered.

Submit resume for confidential handling:

BERKELEY-DAVIS INCORPORATED
subsidiary of
The McKay Machine Company
Box 611 Danville, Ill.

Circle No. 75 on Reader Service Card.

TILLMAN
GLOVES-GARMENTS

WELDORS BUY FROM YOUR DEALER

WELDING GLOVES MITTENS AND GARMENTS NOW IN POLY BAGS

BRAZILIAN DEERSKIN THE "STAY SOFT" LEATHER GLOVES AND MITTENS

John Tillman & Company
1561 W. 19th St.
Long Beach, California

QUIK-HEAT

up to 2200° F.

CLEMENTS

Cadillac

MODELS K3 & M2

BLOWTORCHES

Here are rugged, high efficiency blowtorches that speed up all types of heat treating and production operations. These two Clements Cadillac Blowtorches provide heat up to 2200°F, in seconds and are fully portable.

With the Clements Cadillac model K3 or M2 you can bring the torch to the work instead of the work to the torch as in fixed installations. Furnished fully equipped with 20 ft. of Underwriters' Laboratories and Canadian Standards Association approved 3-wire cable with plug, 10 ft. of gas hose with fittings ready to attach to your gas line and with sturdy, high stability stand. Easily adjustable for height and direction of torch.

Operates on natural, manufactured, or LP-gas.

CLEMENTS MFG. CO.
6646 S. Narragansett Ave., Chicago 38, Ill.
SINCE 1910
INDUSTRIAL PRODUCTS DIVISION

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CADDY

AIR OPERATED
TOGGLE CLAMPS

CADDY AIR OPERATED Toggle Clamps are recommended for jobs requiring fast loading and unloading. Clamps are available in 3 models with clamping pressures from 400 lbs. to 1000 lbs. Furnished with air restrictor fittings to insure smooth operation. Clamps have double action air cylinders. Black rust-proof finish.

Bolt retainer furnished with each clamp.

FEATURES:

1. HEAVY DUTY ALL WELDED CONSTRUCTION—Will withstand extreme abuse—will not spring or bend under maximum load.
2. EXTRA LARGE PIVOT PINS—In actual test under load clamps have withstood over half a million cycles without excessive wear.
3. SMOOTH ACTION—Cylinder restriction fittings give cushioned clamping action.

CADDY® toggle clamp division

Erico Products, Inc.

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IN CANADA: ERICO INCORPORATED, 7 Superior Ave., Toronto 14, Ontario, Canada

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SELL THE WELDER THAT WELDS 'MOST EVERYTHING

EMERSON ELECTRIC TIG-WELD 295

Welds Cast Iron, Rimmed Steel, Carbon Steel, Stainless Steel, Alloy Steel, Nickel, Copper and Copper Alloys, Aluminum and Magnesium

The EMERSON ELECTRIC TIG-WELD 295 for dual welding has built-in high frequency . . . Tungsten inert gas and manual stick electrode processes for both ferrous and non-ferrous work. It's a complete welding shop in one compact package . . . fully rated 295 amps with currents as low as 13 amps.

LOOK AT THESE BIG SELLING FEATURES

- Variable gas and water afterflow
- Direct-remote operation
- Adjustable spark intensity
- Welder on-off switch with pilot light
- High frequency arc stabilizer
- Electrically controlled gas and water valves
- Stainless steel water strainer
- High duty cycles

Write or phone today about profit opportunities on Emerson Electric HF295-30 and HF295-60, Dept. W1.

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8100 FLORISSANT • ST. LOUIS 36, MO.

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